SEPTEMBER, 1928

Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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Published on the last Thursday preceding the month of issue by the

Simmons-Boardman Publishing Company, 105 West Adams Street, Chicago, Ill.

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SAN FRANCISCO: 74 New Montgomery Street

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address please be sure to send us your old address as well as the new one.

Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.)

CONOWINGO Hydro-Electric *speeds to completion with the*

FIVE years ago the village of Conowingo, Maryland, on the Susquehanna River, was a little-known point on the Baltimore Pike: this year it is the site of a giant hydro-electric plant which will furnish the majority of Philadelphia's electricity. It will have a generating capacity ultimately of 594,000 horsepower, saving approximately 750,000 tons of coal annually. Only the Niagara Falls plant is larger. The Conowingo plant dwarfs by comparison the Government-owned Muscle Shoals plant with its 260,000 horsepower, and the Mississippi River Power Company's Keokuk Dam with only 150,000 horsepower.

The entire project is under the control of the Philadelphia Electric Company and its subsidiaries. The estimated expenditure is $52,000,000.

The building of the dam and power plant is only a part of this great project. When the water is impounded by this dam the site of the present village of Conowingo will be under sixty feet of water. By that time, however, a new village of Conowingo will have been built high up on the east bluff. Land occupied by about sixteen miles of the Columbia and Port Deposit branch of the Pennsylvania Railroad will also be under water, necessitating the relocating of this trackage. The Baltimore Highway Bridge, two miles up the river from the dam, will also be flooded. This will be taken care of by new approaches which will divert traffic to the special driveway provided on top of the great dam.

Difficult Blasting

At Conowingo, the Susquehanna River flows through a shallow gorge of granite rock about a mile wide. Test borings show continuous solid rock across the site—ideal conditions for such a project. The hardness of the rock and its irregularity created a number of very difficult blasting problems, chiefly in the building

CONTRACTS

Design and construction of dam and power house:

Stone&Webster, Inc., Boston.

Vice-President, W. L. Locke, and Works Manager, A. W. Clark in charge.

Sub-contract for the construction of eastern portion of dam and also the contract for relocating the tracks of the Columbia & Port Deposit branch of the Pennsylvania Railroad:

Arundel Corporation, Baltimore.

J. J. Hocke, President, and George Angel, General Manager.

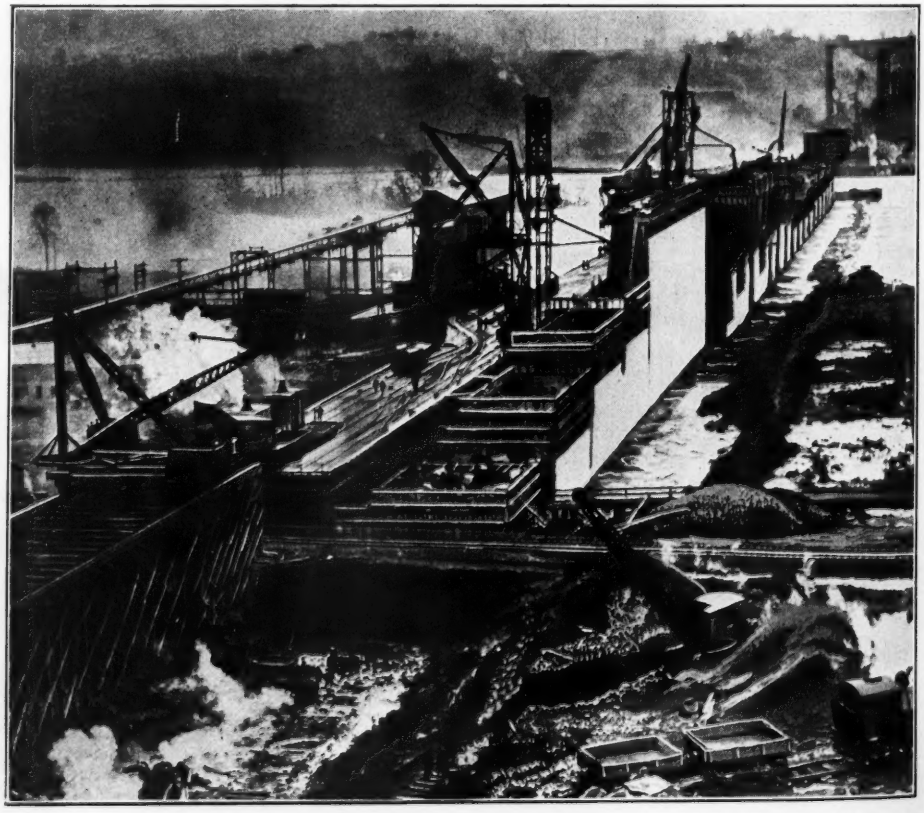
H. O. Firor, in charge of the latter project.

Design and construction of the transmission line and the switching station on the roof of the power house:

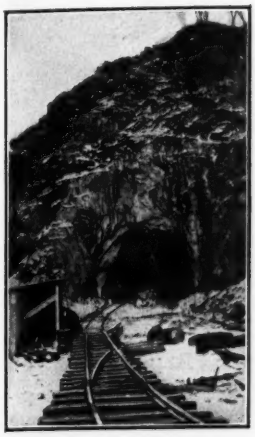
Day & Zimmermann, Inc., Philadelphia.

Construction and subsequent operation of the development under the direction of

Dr. William C. L. Eglin, Vice-President and Chief Engineer of the Philadelphia Electric Company.



Plant, brother to Niagara...
aid of DU PONT DYNAMITE



of the coffer-dam on the west bank enclosing the head works power house and part of the tail race, and in relocating the tracks of the Pennsylvania Railroad.

For this coffer-dam, which encloses an area of 14.7 acres, some 350,000 cubic yards of rock were removed, most of it being used in the construction of the dam. The solid granite was made even more difficult to blast because of the frequent occurrence of irregular seams. The congestion within the coffer-dam added still other difficulties. It was necessary to drill a great many blasting holes, spaced close together.

Relocating the sixteen miles of railroad track required most careful blasting. The new location had to be blasted out of the bluffs and through extremely hard, irregular rock, immediately above the existing tracks. Traffic could not be endangered or hindered by falling rock. Most of the blasting, therefore, had to be accomplished with hammer drills, small diameter holes, and rather small shots of dynamite. For this work, fifty per cent du Pont Quarry Gelatin, size 1¼ by 8 inches, has been universally used. In some places, where the relocated line is some distance from the old line, well drills have been put to work. One shot on Cromley Mountain, near the dam, contained 18,000 pounds of sixty per cent du Pont Quarry Gelatin, 4 by 8 inches, and 1000 kegs of du Pont Blasting Powder, loaded into forty-eight, 6-inch, well-drill holes, averaging about 50 feet in depth. The result of this shot was most satisfactory and approximately 60,000 cubic yards of material were taken from the cut. At three points along the 16-mile stretch of new trackage, it has been necessary to drive through solid granite three double-track tunnels, 275 feet, 360 feet and 270 feet long, each 30 feet wide and 24 feet high.

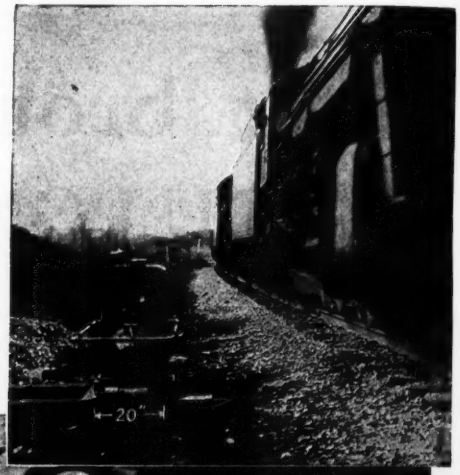
The Significance of du Pont Standards

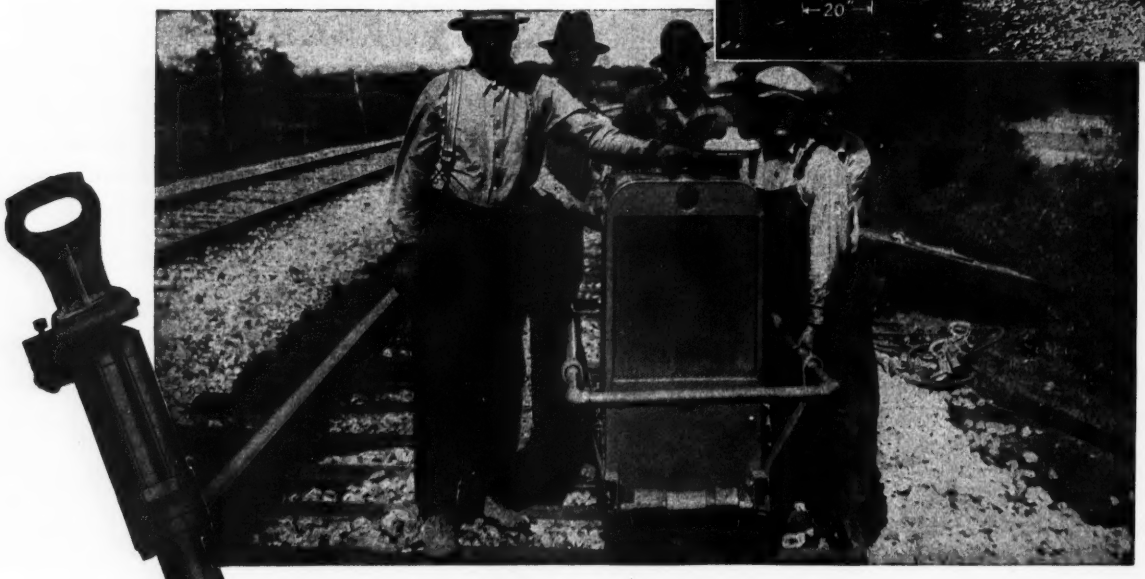
Whether it is a fifty-two million dollar project like Conowingo, or a little quarry blast, or even a few stumps, the quality of du Pont explosives service is uniform. Whether the explosive is the more simply fabricated black granular powder, or the more delicately balanced low-density explosives, the same perfection is always present. From the simplest fuse to the most complicated blasting cap, du Pont accessories keep to the common standard of du Pont excellence. All of which can be summarized by saying that these invaluable intangibles of a product and a service could have no better foundation than a century and a quarter of experience in the manufacture and application of these products.

E. I. DU PONT DE NEMOURS & COMPANY, Inc.
Explosives Department
WILMINGTON DELAWARE

DU PONT
REG. U. S. PAT. OFF.

Easily lifted— —Quickly moved





The Syntron Tie Tamper is gearless and motorless. Nothing moves but the piston, and it cannot be stalled or overloaded. It is driven by the Syntron Power Unit instead of a cumbersome compressor. Each tamper easily cradles "in the lap" of the worker, eliminating strain and back-breaking.

The speed and ease with which the Syntron Tie Tamping Outfit can be moved about is one of the reasons why these efficient outfits are of so much practical value to railroads. Five men can easily lift the Syntron Power Unit. Dolly wheels on the bottom enable it to ride on the rail. In ten minutes it is moved a thousand feet. When off the rail, in use or out, the Syntron Power Unit rests on the track shoulder. Only 20 inches wide, weighing only 750 lbs., there is no danger of mishaps and fewer men are required for the job.

Each Syntron Electric Tie Tamper, delivers 1,500 powerful blows a minute, packs the ballast with a vise-like grip, makes a smooth, firm bed that will outlast hand tamped track by two or three times. Four men with a Syntron Outfit will do the work of twelve men with tamping picks.

Write for literature illustrating and describing the complete Syntron Outfit. No obligation whatever. Address

SYNTRON COMPANY
Lexington Ave. Pittsburgh, Pa.

SYNTRON
Electric Tie Tampers

ELECTRIC TELEWELD PROCESS

Above—
Grinding joint to a true surface

Rail relays successfully deferred by this remarkable process for restoring battered rail ends.

New 100-lb. rail laid in track costs approximately $10,000.00 per mile out-of-pocket money. The interest charges on this amount for only one year will pay for restoration by "TELEWELD" and defer the major expenditure for several years.

Enormous savings are being made annually in rail maintenance by prominent railroads who have adopted "TELEWELD" service.

In preparing your 1929 rail program give "TELEWELD" consideration.

Complete service including equipment, crews and supervision. Responsibility fixed and cost definite.

Five years of satisfactory performance to support our claims of superiority. References on request.

A representative will gladly call and explain further details. We make track surveys and proposals without expense or obligation to you.

San Francisco
952 Howard Street

Salt Lake City
Continental Bank Bldg.

ELECTRIC RAIL WELD SERVICE CORP.

Denver
2101 Blake Street

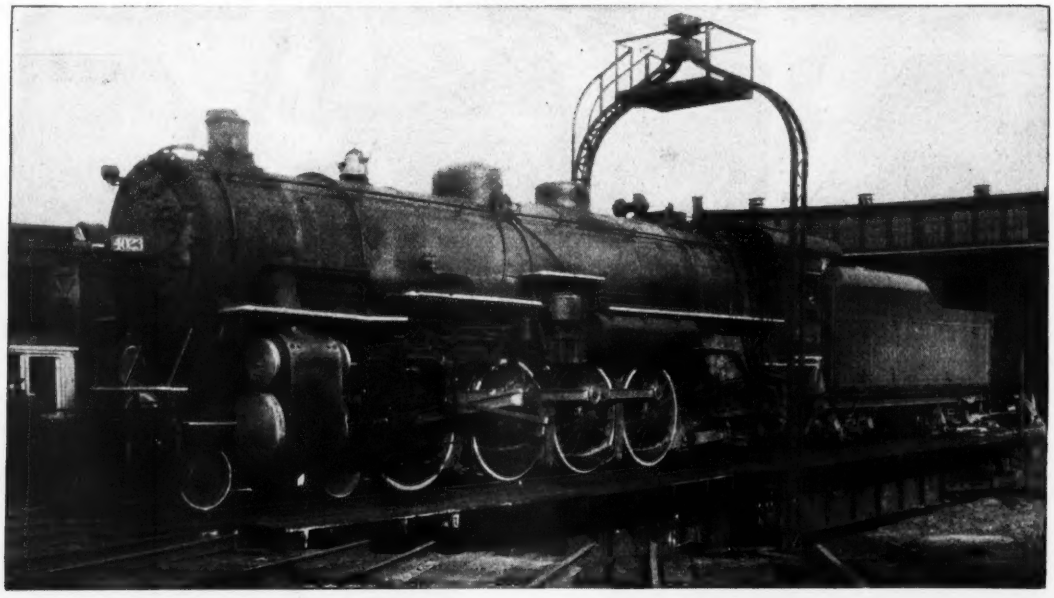
RAILWAY EXCHANGE BUILDING, CHICAGO

Spokane
Old Nat. Bank Bldg

Typical picture of rail ends showing low joints

Same rail ends rebuilt by Teleweld

New Concrete Base Placed Late Saturday.... Turntable Back In Service Early Monday



IT was essential that this Rock Island turntable at Herington, Kansas, be available for use at all times. That's why Quikard Cement was used for constructing the new concrete base. The job was completed Saturday evening. Early Monday morning, the 80-ton steel turntable was put back in service. Such performance can be depended on with Quikard Cement—a true Portland Cement that develops 28-day strength in 24 hours!

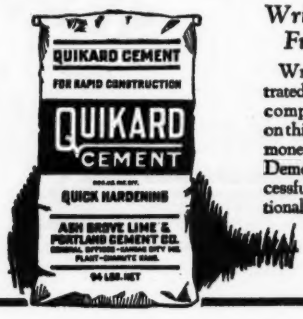
Quikard requires no admixtures or accelerators. Mixed in standard proportions, it attains this tremendous early strength—and, in addition, develops increased strength thereafter. It not only meets U. S. Govt. and A. S. T. M. standard specifications for Portland Cement, but exceeds all strength requirements.

Quikard is *not* quick-setting. It takes its initial and final set normally, allowing plenty of time for proper mixing, placing and finishing. It is plastic, easily finished, dependably uniform. It produces an exceptionally waterproof concrete that forms a perfect bond with new or old Portland Cement concrete.

Quikard affords you *all* these advantages. Its efficiency and dependability have been proved beyond question on important projects throughout this territory. It will save you time, labor and money. Use it for rapid construction!

Produced Only by
ASH GROVE LIME & PORTLAND CEMENT CO.
Founded in 1882
610 Grand Avenue Temple, KANSAS CITY, MO.

QUIKARD CEMENT

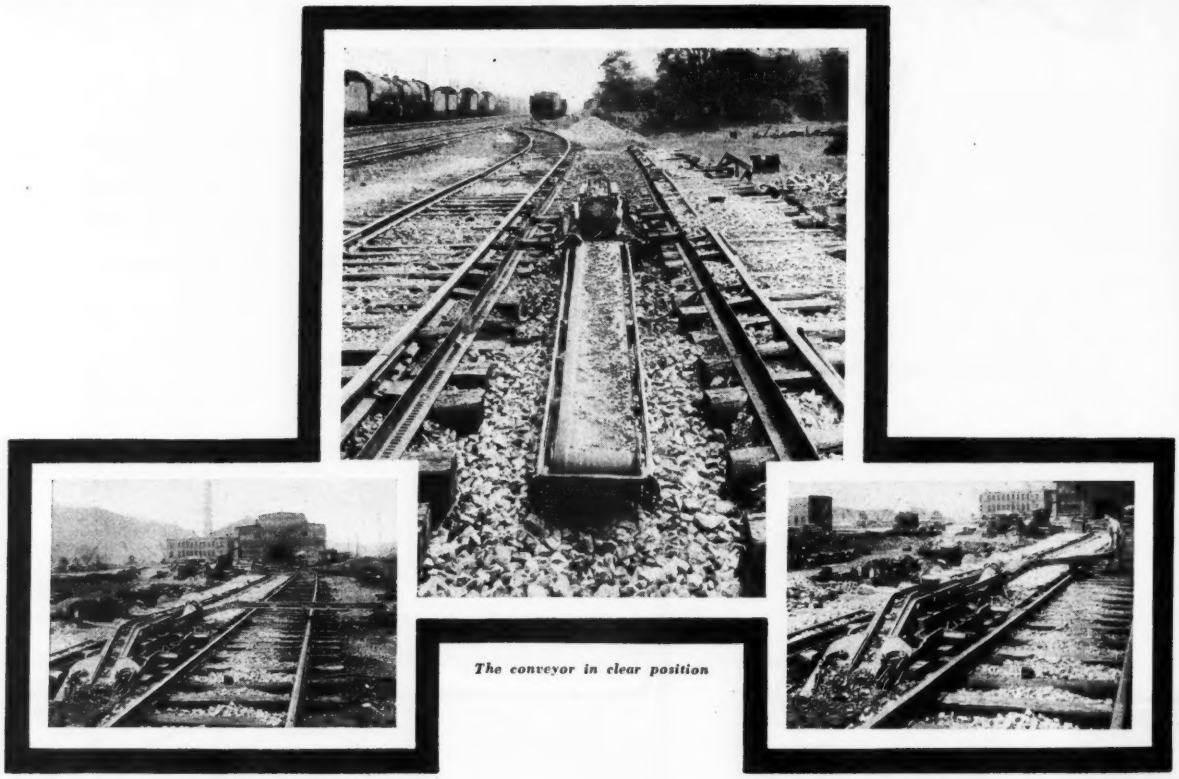


Write for Full Details

Write today for illustrated literature giving complete information on this proven time and money-saving cement. Demonstrates its successful use on additional important jobs.

10

McWILLIAMS
BALLAST CLEANING DEVICES



The conveyor in clear position

Conveyor in operating position

Conveyor being swung to clear

A NEW SWING CONVEYOR

—has just been developed and perfected by this company for use with the McWilliams Mole.

This conveyor will deliver the dirt to either side of the track when desired and swing to the clear. It is no longer necessary for laborers to carry the dirt from the rear of the "Mole," and the amount of labor required to operate the "Mole" is therefore reduced at least fifty per cent.

Write for the facts

RAILWAY MAINTENANCE CORPORATION

Pittsburgh Penna.

For Hard Service—and Lots of It

YOU can expect the best service from Woodings Tools because they have the best of everything in them. The exceptional durability of the steels used positively insures remarkably long life under severe service conditions.

The high quality workmanship of Woodings Tools is no chance occurence. The tools are made by men who have devoted the major part of their lives to tool making. Each tool is subjected to rigid tests and critical inspections.

Woodings Tools have won preference by better performance. Repeat orders are increasing daily due to the long dependable service Woodings Tools are giving.

Our track chisels are rapidly becoming acknowledged as the most economical rail cutters in the field today. Initial cost is low—life is exceedingly long, therefore they are most economical.

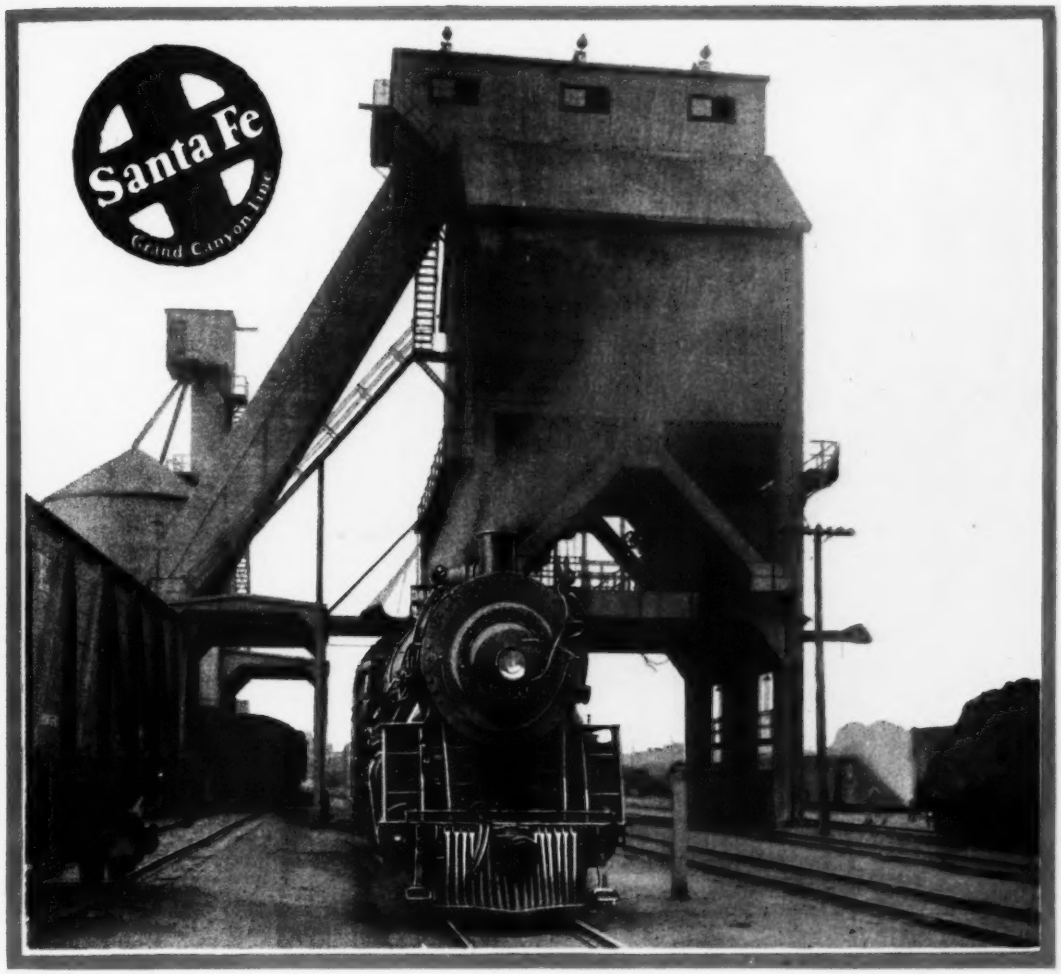
A test will soon demonstrate the wearing qualities of Woodings Tools.

Woodings Forge & Tool Co.

Works and General Sales Office

Verona, Pa.

WOODINGS
STANDARD TRACK TOOLS



"The Chief" is coming!

Marked up on the boards as on time "The Chief" is roaring into the division point where another Santa Fe locomotive already supplied with coal and sand from a Fairbanks-Morse Station waits to take her over the next division.

And Fairbanks-Morse Coaling Stations are a familiar sight to "The Chief." Fifty-six of them! Strung out between Chicago, the Pacific Coast and the Gulf serve Santa Fe trains. For on a system that clicks as smoothly and promptly as the Santa Fe, coal and sand facilities must be of the best. The schedules of The Chief, The Scout, The California Limiteds and The Missionary ofttimes permit only a pause beneath the quick servicing chute of a Fairbanks Coaling Station.

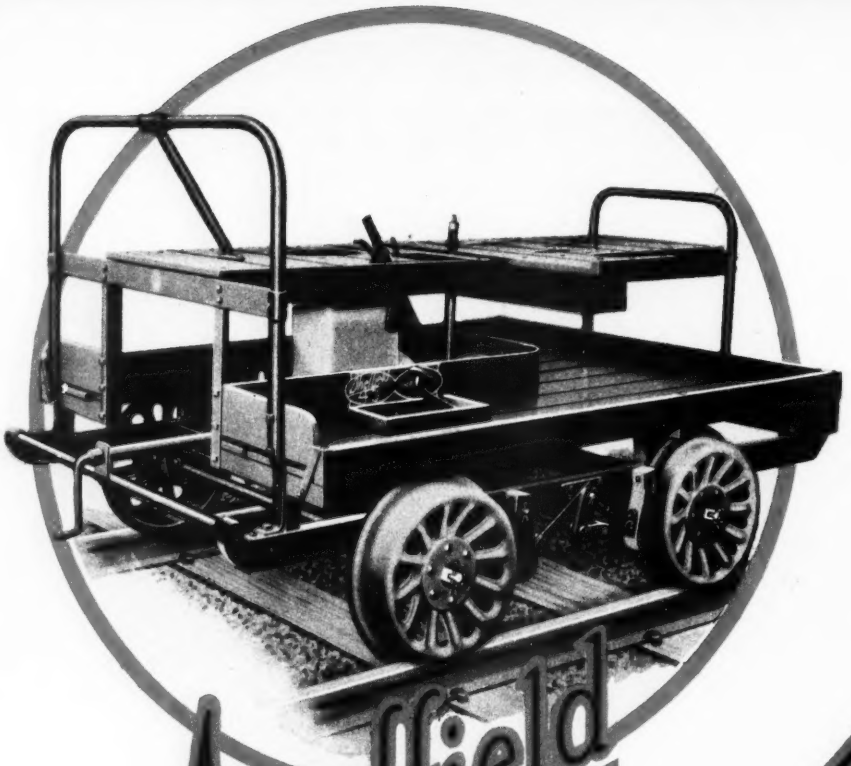
Engineering to meet the specific requirements of the particular location—every item of the *equipment* made in Fairbanks-Morse Plants —*erection* by Fairbanks-Morse engineers—the Santa Fe has placed the single, undivided responsibility for the completed plant in the hands of Fairbanks-Morse on 56 separate occasions.

POWER PUMPING AND WEIGHING EQUIPMENT

FAIRBANKS-MORSE COALING STATIONS

FAIRBANKS-MORSE COALING STATIONS

FAIRBANKS-MORSE *Motor Cars*



Sheffield No. 45

REFINEMENTS TELL THE STORY

In offering to railroading the new No. 45, Fairbanks-Morse has produced the best medium-duty section car that ever appeared on rails. For consistent reliable transportation of a section crew with tools and trailer to and from work at *low cost* the "45" is the ideal car.

Its many refinements tell the story of its quality! A two-cylinder "Ricardo" head, air-cooled, opposed type, free running engine. Force-feed lubrication. Variable speed friction transmission with roller chain drive to the axle. Axles and engine crankshaft are mounted in Timken Tapered Roller Bearings. Transmission countershaft in SKF Double Row Self Aligning Ball Bearings. Pressed steel frame and three-point engine suspension and safety body. Ground treads on the wheels.

Railroad men are invited to check every feature—to judge for themselves the exceptional service this car can give. Full specifications and description sent on request.

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

TIMKEN BEARING EQUIPPED

First on the rails—and still first

FAIRBANKS-MORSE MOTOR CARS

The Spike Puller being operated from I-R Tie Tamper Compressor

Ingersoll-Rand SP-9 Spike Puller. Note how the spike is gripped.

An Air-Operated Spike Puller That Does the Work of 15 Men

The Ingersoll-Rand Spike Puller (Size SP-9) is a new tool that has been developed to save time and labor. Operated by one man, it will pull 8 to 10 spikes per minute; —in round numbers, 500 per hour.

This machine is light enough to be moved by hand from tie to tie. Its air requirements are very low, the average consumption being only 3 cubic feet of air per spike.

INGERSOLL-RAND COMPANY
11 BROADWAY NEW YORK CITY

Offices in principal cities the world over
For Canada Refer—Canadian Ingersoll-Rand Co., Limited,
10 Phillips Square, Montreal, Quebec

257-TT

Ingersoll-Rand

A Partial List of Railroads using UNIVERSAL PIPE

Chicago and Northwestern
Florida East Coast
New York, New Haven & Hartford
Chicago, Burlington and Quincy
Long Island
Louisville & Nashville
Delaware, Lackawanna & Western
Mobile & Ohio
Canadian Pacific Railway
Pennsylvania Lines
Boston & Albany
Boston & Maine
Central Vermont
Wheeling & Lake Erie
International Railways of Central America
Truxillo R. R. of Honduras
Tela R. R. of Honduras

Dependable water supply Savings all along the line

NOTHING here to deteriorate, nothing to blow out, nothing to work loose. These tight, flexible joints stay tight because the *joint* as well as the pipe is *all-cast-iron.*

No lead, lead-substitutes, nor any other jointing materials. No pouring, no calking, no bell holes to dig.

Tools? Just wrenches!

The contact surfaces of the hub and spigot ends are machined on a slight differential taper making a natural iron-to-iron joint that amply provides for expansion and contraction, vibration and uneven ground settlement.

Approved by the Underwriters Laboratories which are under the direction of the National Board of Fire Underwriters.

Valves and hydrants of the best known makes are obtainable with the Universal Pipe machined joint.

For water supply, fire protection and other service where freedom from leakage is essential. Easier! Quicker! Safer! *Address nearest office.*

UNIVERSAL CAST IRON PIPE

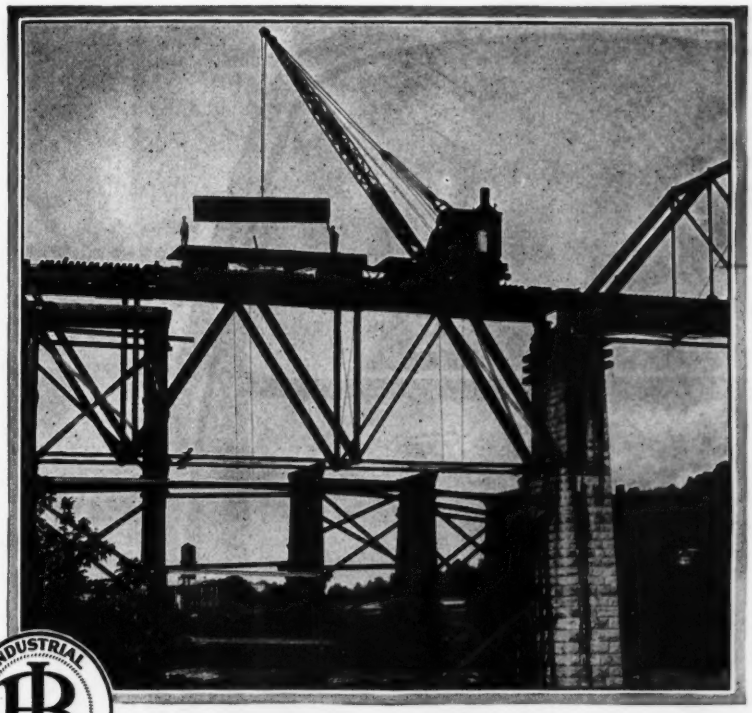
No bell holes to dig No joints to calk

THE CENTRAL FOUNDRY COMPANY

Subsidiary of The Universal Pipe and Radiator Company

Graybar Building, 420 Lexington Avenue

Chicago Birmingham New York Dallas San Francisco



"The Structural Worker" by the sculptor, Max Kalish.

Allies In Construction Work

Speedy dependable workers and an untiring Industrial Brownhoist crane... there's the answer to completing a construction job on time and with a good margin of profit.

Unloading and placing structural steel, handling materials for the mixer, switching cars...all of these jobs and many more these locomotive cranes will handle with unequalled speed and a great saving of labor. They are equipped with either crawler or railroad trucks and with steam, gas or electric drive.

Our nearby representative will be glad to furnish you a list of companies that have materially reduced construction costs with Industrial Brownhoist cranes and shovels. This list includes most of the country's foremost contractors.

Products

Locomotive Cranes, 6 to 60 tons capacity, Wrecking Cranes, 75 to 200 tons capacity, Gas Shovels, ½ to 1¼ yards capacity, Bridge Cranes, Heavy Dock Machinery, Creeper Cranes, Pile Drivers, Belt Conveyors, Chain Conveyors, Grab Buckets.

Industrial Brownhoist Corporation

General Offices: Cleveland, Ohio.

Factories: Cleveland, Ohio; Bay City, Mich., Elyria, Ohio

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INDUSTRIAL BROWNHOIST

Kyrock Under Traffic 5 Years. Note the Edges

Latrobe-Kingston Road, Westmoreland County, Pa. Kyrock laid 1923. Photo 1928

A Kyrock Top Saves Concrete Roads

The Kyrock top protects the old base and prevents further disintegration. Surfacing with Kyrock may be done on half the road at a time without interruption to traffic. Kyrock is laid *cold*. It is resilient, non-reflecting, NON-SKID. On concrete it reduces vibration 75%. *Investigate Kyrock.*

This concrete highway, when five years old, was surfaced with Kyrock for a distance of one mile. The old concrete was paint-coated and Kyrock raked and rolled (1½ inch compacted) *flush with the edges of the concrete.* These two views show that the *unprotected* edges of the Kyrock surface stand up under the abuse of vehicles running on and off the pavement. Write today for Kyrock data.

KENTUCKY ROCK ASPHALT CO., *Incorporated*, LOUISVILLE, KENTUCKY

Kyrock

The Uniform Pavement

KENTUCKY ROCK Kyrock ASPHALT

Combination cattle pass and pedestrian passageway

MASSEY flat base pipe provides ample headroom for pedestrians. In the installation pictured, an old wooden trestle is being filled and the Massey pipe installed for use of either men or livestock. A locomotive crane quickly sets the sections in place. The fill can then be made immediately.

There are many locations—at yards and in grade crossing separations such as the one illustrated—where Massey flat base pipe most economically provides a suitable underpass.

Our new booklet, "Special Pipe For Special Purposes" describes this and other types of Massey pipe. A copy will be sent on request.

MASSEY

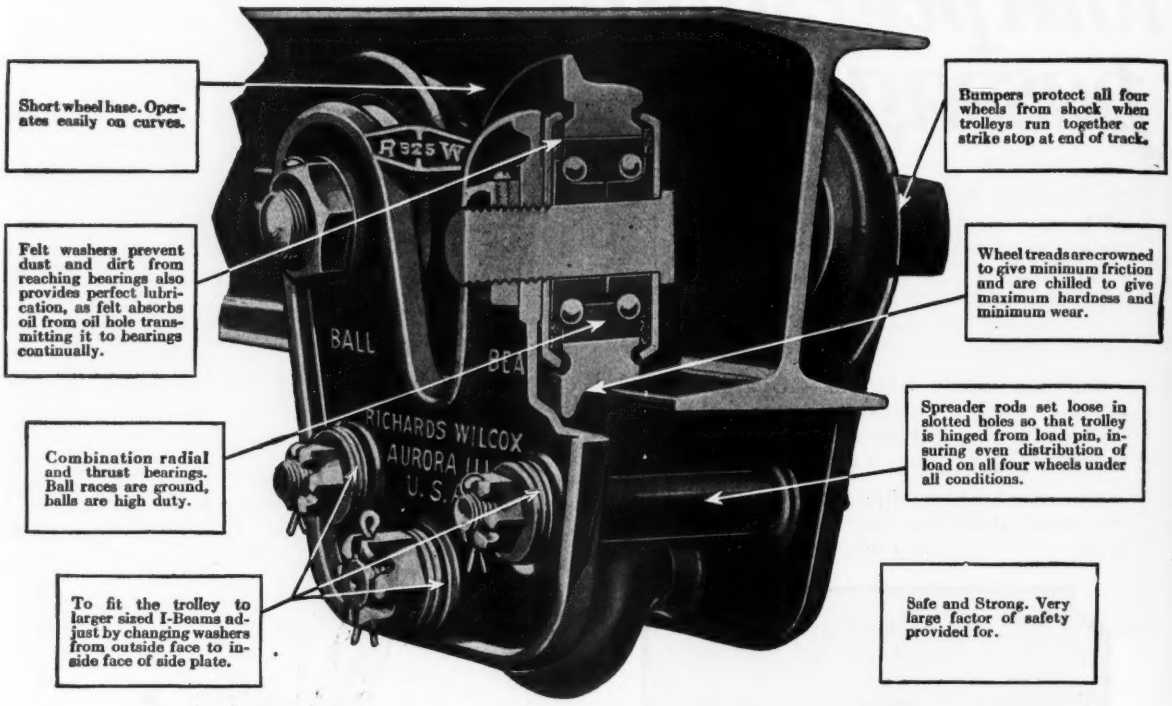
CONCRETE PRODUCTS CORPORATION
Peoples Gas Building, Chicago

Sales Offices: New York, Atlanta, Cincinnati, St. Louis, Los Angeles
Canadian Concrete Products Co., Limited, Transportation Building, Montreal, Que.

Factory-Made REINFORCED CONCRETE PRODUCTS

REM9—Gray

MORE NEWS



about R-W Ball-bearing trolleys

Month after month, evidence of the outstanding superiority of R-W Ball-Bearing Trolleys keeps piling up.

In a recent test the R-W 925 Trolley, carrying a one-ton weight, was started with the pull of a man's little finger!

Then there is the experience of the Mitchell Steel Company, whose president, Wm. H. Mitchell, writes: "Our tests show that the R-W Trolley is approximately 50% more efficient than any other we have ever tried," and we have tested many makes.

Another large organization which has put R-W Ball-Bearing Trolleys to severe tests is the Kohler Company. As a result of these tests they have purchased more than 2,000 R-W Trolleys.

We could go on for page after page showing you how R-W Trolleys are "doing their stuff" under actual working conditions. But why not test out the R-W Trolley for yourself? It will cost you nothing to do so.

Make This Test at Our Expense

To prove the efficiency of the R-W Ball-Bearing Trolley in your own plant we make this offer:

Tell us your requirements, and we'll send a Trolley of suitable capacity. Put it to the test under actual working conditions. If it does not more than come up to your expectations, send the Trolley back at our expense.

This offer, plus our engineering advice, will place you under no obligation of any kind. We suggest that you act on it today.

Richards-Wilcox Mfg. Co.

"A Hanger for any Door that Slides"

New York • • • AURORA, ILLINOIS, U.S.A. • • • Chicago

Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines
Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit

Montreal • RICHARDS-WILCOX CANADIAN CO., LTD., LONDON, ONT. • Winnipeg

(900)

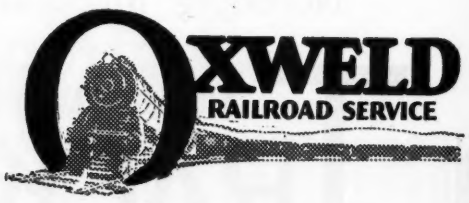
A new chapter in railroad history

ON Jan. 26, 1928, the caboose and the locomotive cab of a mile-long moving freight train maintained constant communication with each other and with a railway signal tower by radiophone. The order to start the train was given from the caboose to the engineman more than a mile ahead and instructions for stopping were transmitted in the same way.

Because of increased efficiency in the handling of freight trains, the railroads have increased the average distance traveled per freight car per day from 22.4 miles in 1921 to a record of 34.7 miles in October, 1927. It is expected that the use of the radio will speed up freight train operations still further.

Long before radio was an actuality the Oxweld Railroad Service Company in their way was helping railroads to increase their operating efficiency. And in recent years it has developed several applications of the oxy-acetylene process that are as outstanding in their own field as the radiophone. Oxweld Railroad Service is progressive service.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
New York City: Carbide and Carbon Building
Chicago: Railway Exchange



A Bed for a Headstone!

For over 150 years this Cypress Board has been little affected by rain and rot

IN 1770, an eccentric lady of Charleston, S. C., requested that her grave be marked by the footboard of her bed.

Her judgment has now been justified, for the letters on the board have remained legible long after nearby stone inscriptions were effaced.

Because it continually affords such durability as this, millions of railroad ties are made of Tidewater Red Cypress. Shipbuilders use it in enormous quantities. More acid and water tanks are made of it than any other lumber. Many houses built of it are over two hundred years old and still in excellent condition.

Tidewater Red Cypress is especially adapted for

Passenger Station Construction

Freight Sheds and Warehouses

Platform Construction

Conduits for signalling systems

Water Tanks—Box Cars—Cattle Cars—Refrigerator Cars

Yard Fencing

In short, any use where long life and absolute freedom from repairs are essential.

Whenever you want to purchase long life and freedom from repair at moderate cost, specify "heart grade Tidewater Red Cypress." This Wood Eternal brings upkeep down with a thump. To give generations of service, it doesn't even have to be painted.

Complete information on this wood for industrial and home-building uses will gladly be sent on request. Southern Cypress Manufacturers Association, Department RE-9, Jacksonville, Florida

Specify TIDEWATER RED CYPRESS

THE WOOD ETERNAL

In 1889 this main was laid by the old New Orleans Water Co. On the left it is shown being salvaged 24 years later. And on the right, in perfect condition, the same pipe is being relaid in the water system of Port Arthur, Texas.

After 24 Years this cast iron pipe starts a new job

USUALLY when cast iron pipe is laid, it is in the ground for good. It can be forgotten. A century or two of service is no uncommon record.

But, in rare instances, pipe lines must be removed as in the case of this main installed many years ago in New Orleans. The left-hand photograph shows it being taken out of the ground in perfect condition, after almost a quarter century of service. And at the right you see the same pipe starting again in service under the streets of Port Arthur, Texas. Nothing could illustrate more forcefully the age-defying quality of good cast iron pipe.

Much helpful data for the engineer and contractor is contained in the U. S. Cast Iron Pipe Handbook. Write for your copy now.

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WASHINGTON, D.C.

Railway Engineering and Maintenance

Volume 24 September, 1928 No. 9

Uniform Maintenance Forces

ALTHOUGH one does not hear as much discussion as he did a few years ago of the economy of laying rail in the winter, this practice is steadily gaining ground, indicating that it has progressed beyond the point of argument. In a somewhat similar manner and for probably a similar reason one hears less of late, of the uniform maintenance forces.

It is true that most of the roads still have much progress to make in redistributing their work before even approximate uniformity of forces is possible. A real advance is being made, however. Particularly encouraging is the fact that the advantages of this practice are now conceded more generally than a few years ago. Recognizing this, one road after another is transferring tasks from the midsummer peak to other seasons, thereby reducing the maximum labor demand and extending the working period for those employed throughout a larger part of the year.

Encouraging as is this progress, however, it is only a start. For the present at least, it may not be practical to maintain a uniform force summer and winter. It is possible, however, to go further in this direction than the average road has yet gone, with benefit alike to its employees and itself. The advantages of a uniform, experienced force are growing with the increasing adoption of labor-saving equipment that requires fewer, but more highly trained, men for its efficient utilization. It is pertinent to consider the merits of a more uniform labor force at this season when the possibility of diverting work to less active seasons is of primary interest.

Watch the Flangeways!

THE RAPID increase in highway travel has created many problems for the railways, not the least of which is the necessity for the improvement in the character of construction of the roadways across the tracks. This improvement has been provided for the comfort and safety of the user of the highway. A recent accident on a western road directs attention, however, to the fact that it is essential to consider the form of its construction from the standpoint of travel on the railway as well.

In this accident a passenger train was derailed at a crossing by material that had been drawn into the flangeway by highway vehicles. In this instance, the crossing was located at the foot of a hill on a little-used highway but which on the day in question was subjected to heavy travel by reason of a picnic in an adjacent grove. In descending the hill the vehicles had brought gravel down with them which lodged in the flangeway until it was filled.

While the conditions surrounding this accident were unusual in more than one respect, they emphasize the necessity for frequent inspection of these flangeways to insure that they are not allowed to become filled with foreign materials. In the horse and buggy days this danger was almost non-existent, but with the greatly increased number of vehicles, carried on balloon tires and traveling at high speeds, on gravel and earth roads the menace is a very real one. This change in highway travel adds another responsibility to the already long list carried by roadmasters and track foremen.

No Shortage of Materials Now

RAILWAY officers are so vitally concerned with the present that they find little time or inclination for reflection on the experiences of the past. The troubles of today overshadow those of yesterday. Even the eventful days of the World War and government control are now but infrequently subjects of conversation. The 10 years of readjustment following the signing of the Armistice have effected such a gradual change that it requires a review of the printed record to reinforce the memory of troubles of the war days.

That the shortages of men were so acute that women were employed in track work is readily recalled. But how many roadmasters or master carpenters recall with equal vividness the stringent scarcity of materials, the slow deliveries and the high prices? This latter phase of the war period stands out in sharp contrast with the present. As noted in the Material Market review on page 401, the past month was distinctive by reason of the stability of material prices. This implied a comparison with other recent months during which some moderate changes took place. As a matter of fact, the entire past year or even two years embrace a period of limited fluctuation in prices as compared with the range of prices during the war years and the two or three years immediately following.

For example, the listed price of a 100-lb. keg of track spikes is now $2.80 and has been the same for over a year. In November, 1916, it was only 5 cents more, or $2.85. It rose to $3.50 in March, 1917, to $4.50 in July and to $6.00 in October. It was fixed by the War Industries board at $3.90 in December, 1919, dropped to $3.35 during the year following the Armistice, but rose again to $4.00 during the wildcat buying of 1920, only to drop to $2.25 by 1922. Similar fluctuations affected most railroad materials, making estimates a matter of extreme uncertainty and resulting often in a large over-run in actual costs.

But cost faded to insignificance compared with the problem of getting delivery, and during 1918 and 1919 the question was reduced to whether or not materials could be had at any price or any date of delivery. So hard was it to get new rail, that relayer rail sold at one time at $65 per ton, and little could be bought even at that figure.

These days of stable prices and prompt deliveries relieve the man who orders and applies material of a multitude of worries and complications that beset him in the war years.

Are Tie Plates Large Enough?

IT HAS long been recognized that ties fail from two principal causes, decay and mechanical wear. To overcome the first of these destructive agencies, the treatment of the timber with preservatives has become the almost universal practice. As the benefits of wood preservation have become more pronounced and the investment in the tie and in its treatment has risen, the economic necessity for its corresponding protection against mechanical destruction has increased. The most outstanding and the least warranted cause of this destruction is that resulting from the cutting of the rail base into the tie by reason of the load transmitted through the rail exceeding the bearing strength of the timber. To meet this condition, tie plates have been introduced, relatively small in area at first, but increasing in size as the loads have risen and the crushing of the wood has continued, as noted in an editorial entitled "Should Tie Plates Be Wider?" which appeared in the last issue.

It has commonly been considered that the sinking of the tie plates into the ties is an evidence that the tie plates are of inadequate size. As a result of an extended study of this subject in this country and abroad, however, Dr. Hermann von Schrenk arrives at a different conclusion as indicated on page 372. By examination of numerous ties after they have been in service for a considerable time, he has found that the wood under the tie plates is rough, fiberous or splintered, rather than crushed. He has found further that this splintering is more pronounced in the common form of track construction, where the rail is fastened to the tie and the plates held more or less loosely in place by the same cut spikes, than where the plates are held more rigidly in place by screw spikes, as on the Lackawanna, and that the crushing practically disappears on the P. & L. E., where the tie plates are attached rigidly to the ties by fastenings independent of those which hold the rail in position. From these studies Dr. von Schrenk concludes that the mechanical destruction of ties is due to abrasion rather than to the crushing of the fibers. To overcome this he recommends the use of tie plates free from projections, flanges or other irregularities and fastened to the ties independently of the rail.

In placing responsibility for the mechanical destruction of ties on abrasion, Dr. von Schrenk is advancing a thought which, while not original, as evidenced by the P. & L. E. practice for more than a decade, is new to most students of this subject. Because of the fact that for a long time tie plates were obviously inadequate in area for the loads which they were called upon to distribute, railway engineers have become accustomed to attribute all embedding of the plates into the ties to lack of bearing area. Dr. von Schrenk's conclusion raises a question as to the universal accuracy of this position. While it can readily be shown that millions of tie plates are still inadequate in size for the service required in them, a condition which it may be assumed that Dr. von Schrenk recognizes although he does not so state specifically, his conclusion opens up a new line of thought for maintenance officers, for it is possible that at least a part of the mechanical destruction of ties now attributed to inadequate tie plates may in reality be due to the chafing of the timber by these tie plates. This question is one which can be studied on every railroad and answered in the light of the conditions there prevailing.

Filling Vacancies

WHILE the average length of service of maintenance of way foremen is probably equal to or greater than that of men of similar rank in other branches of railway work, it is inevitable that changes will occur from time to time. One of the most important duties of roadmasters and supervisors of bridges is the selection of men to fill these vacancies as they arise. It is commonly recognized that one measure of the ability of such an officer is afforded by the judgment displayed by him in choosing men for these positions. After a man has been appointed to a position, however, the supervisory officer has an equally important duty in training him in the details of his duties.

It is, of course, expected that a man appointed to a foremanship has served a sufficient apprenticeship to learn the technique of the work thoroughly. By reason of his added responsibilities, however, he takes over new duties. He must now direct, where he formerly followed instructions. On his decisions depend in large measure the efficiency with which the work is conducted and not infrequently the safety of his men and of traffic as well.

Because of these facts the efficient supervisor gives special attention to such a man, both by way of thorough instruction in all details of his new work as it is turned over to him, and by sympathetic correction of his mistakes as he progresses in his duties. The supervisor who appoints a man to a new position and then "turns him loose" deliberately, or through neglect, courts disaster, while the officer who guides and coaches his men until they become thoroughly familiar with their duties, builds an organization. No greater opportunity is afforded a supervisor to demonstrate his ability than in the selection and training of men to fill vacancies in his organization.

We Are Making Progress

IN 1906, one of the issues of *Railway Engineering and Maintenance of Way* (predecessor of *Railway Engineering and Maintenance*) contained an illustrated advertisement for a labor-saving device or what was purported to be one. It was a tool grinder provided with a clamp by means of which it could be attached to the body of a hand car in such a position that it could be belt-driven from one of the lever-propelled wheels which had been raised off the rail. Another advertisement, which appeared in 1910, illustrated a hand car equipped with a small gasoline engine. But as the car in the picture was provided with levers and the men were standing on

the car, it is evident that it was still considered advisable to have the hand power available in case the engine refused to operate. Nothing could illustrate more emphatically the primitive nature of labor-saving equipment in track maintenance as recently as 20 years ago.

However, it must be remembered that at that time there was an entirely different attitude toward manual operations. Steel bridges of considerable size were still being erected without the use of pneumatic riveters when the job was considered too far out of the way or too small to justify the setting up of a compressor. Even as late as 1915 a few railroads were mixing concrete in mixers operated by hand cranks. However, this was not due to the fact that railway bridge men favored these hand-power machines to any one of the many power mixers then on the market, but because the hand machines cost much less money and it was much easier to get approval for their purchase from managements that had not yet been educated to the economy of labor-saving equipment. Illustrations such as these show how far we have come in recent years in reducing the drudgery of maintenance of way work, and in cutting the labor bill.

New Ideas

SOME TIME ago we received a letter from a track foreman on a western road asking us to secure from the manufacturer and send him a device advertised in our pages. While we might cite this as a demonstration of the pulling power of advertising in our publication, the point we desire to emphasize at this time is the earnestness of this man, which caused him to offer to pay out of his own limited income to equip himself with a tool which his road had not yet bought for him. In behalf of the road in question it may be said that when this incident was brought to the attention of its officers, this foreman was not only provided with the device desired, but his check was also returned to him. Further, this foreman's interest in the device in question led the road to investigate its merits, with the result that many other foremen have since been provided with the same equipment.

It is not our thought here to suggest that foremen or other employees undertake to provide the equipment that they need for their work at their own expense. We believe, however, that they should be encouraged in all times to be on the lookout for new ideas and to bring these ideas to the attention of the supervisory officers. We believe even more that supervisors, division engineers and even higher officers can be more alert in this direction than many now are. All too frequently one hears the remark, with an air of resignation, to the effect that "That's what the company furnishes" and lets the matter drop there.

The thoroughly successful man and the one who is most respected for his views is the one who first convinces himself of the advantage to his road of a new device, material or method and then proceeds to gather sufficient facts to prove the correctness of his conclusion to the satisfaction of his superior officer. Few roads fail to encourage such action, for it is widely recognized that that road progresses most rapidly whose employees from top to bottom are constantly on the alert for new ideas to improve the efficiency of their respective operations.

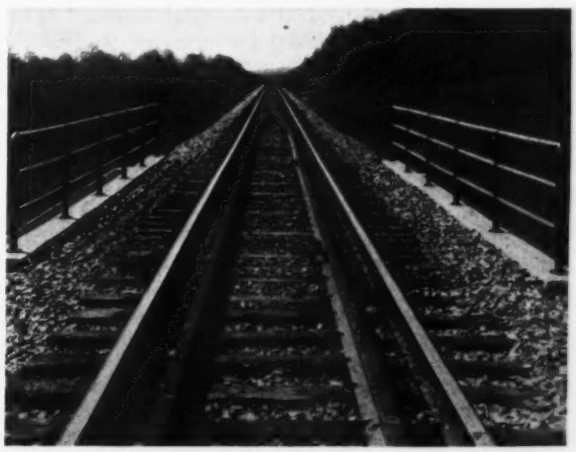
New Books

Proceedings of the American Railway Engineering Association.—Volume 29, 1928. 1,449 pages, Bound in cloth. Published by the association, E. H. Fritch, secretary, 431 South Dearborn Street, Chicago.

The annual proceedings of the American Railway Engineering Association for 1928 contain the reports of 22 regular committees and three special committees presented before the convention last March, together with the discussions thereon. Among the reports of special value, contained in this volume, was that of the Committee on Ties on anti-splitting devices, in which tests made in the laboratory of the Pennsylvania railroad were described, and another on the size of holes for pre-boring for spikes, based on tests made by the Atchison, Topeka & Santa Fe. The Committee on Rail included a description of a device for detecting transverse fissures, which was developed under the auspices of that committee. The Committee on Track, in addition to presenting standard plans for manganese and other crossings and frogs, also continued the study of methods of reducing rail wear on curves, and the cause and effect of brine dripping. The report of the Committee on Economics of Railway Labor continued its investigations of the extent to which it is practicable to stabilize employment in the maintenance of way department and recommended the equalization of expenses as a means to that end.

Fifteen monographs issued during the year were reprinted in the proceedings, these including one on the highway grade crossing problem by R. H. Ford, assistant chief engineer of the Chicago, Rock Island & Pacific, and another on sink-head ingots, by R. S. Harden, office engineer on the Pennsylvania, followed by one by Dr. George K. Burgess, Chief of the Division of Metallurgy of the Bureau of Standards, treating of investigations of rails rolled from sink-head ingots and those rolled from ordinary ingots.

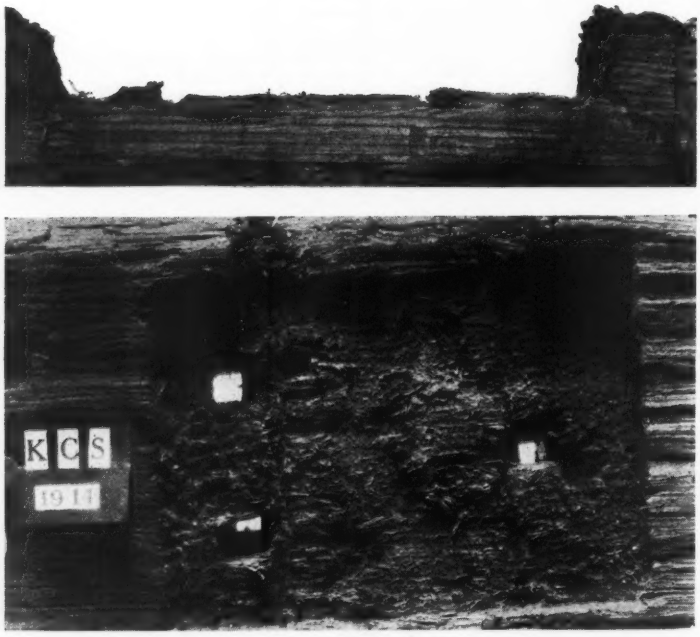
Of general interest was the report of the Special Committee on Convention Procedure as to the changes which should be made in the conduct of the work of the association in order to increase its effectiveness in its chosen field.



On the Buffalo, Rochester & Pittsburgh

What Causes Mechanical

A Study of the Forces That of the Fibers of the Base or Beneath



By DR. HERMANN VON SCHRENK
Consulting Timber Engineer, New York Central, St. Louis, Mo.

Top View and Longitudinal Section of a Typical Worn Red Oak Creosoted Tie. Note the Fuzzy or Woolly Effect of the Wearing Action, Which in Most Cases Is Confined to the Surface.

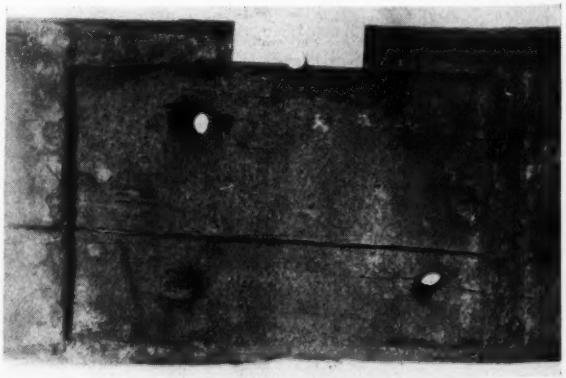
IT APPEARED to me many years ago that an absolute prerequisite to a properly designed method for the mechanical protection of ties was a definite answer to the question, "What is the cause of mechanical wear?" To date, so far as I can find, there have been simply expressions of opinion. Omitting all those references which deal with mechanical wear in connection with decay, there have been two "opinions"; one, that mechanical wear is due to the movement of the tie plate, and the other, that it is due to the compression of the wood because of excessive loading.

Studied a Large Number of Ties

It occurred to me that a critical examination of the wood which had been forced into the tie under the tie plates might enable one to answer the question as to what mechanical wear really was due. Accordingly, a large number of ties were collected which showed typical mechanical wear phenomena. Many extreme cases were picked for detailed study. All of the ties selected were such as had been removed from the track because the tie plates and rails had sunk into them to a sufficient extent to require their removal. All of the ties examined, with the exception of several white oak, cypress and redwood ties, were creosoted. In all cases, a critical examination was made of the character of the surface of the tie immediately under the tie plate and rail. Also, careful comparisons were made with the surface of the tie immediately outside of the rail bearing. The ties were then cut longitudinally and across the bearing area and an examination was made by the naked eye of the wood fibers immediately below the tie plate seat and at some point in the tie immediately adjacent to the seat. Typical pieces of wood from the tie plate area as well as from the area immediately outside of the tie plate were then subjected to microscopic study. Through the courtesy and with the assistance of the Forest Products Laboratory of the U. S. Forest Service, microphotographs were prepared which served as a further basis for study.

Sinking of the Tie Plate into the Tie

Mechanical wear manifests itself by the apparent sinking of the tie plate or rail into the tie, so that sooner or later the tie plate looks as if it had sunk into a pocket. In some cases this pocket is deep enough so that the top surface of the tie plate is lower than the original top of the tie and the rail has then begun to sink into the edges of the tie. These pockets are generally almost the size of the tie plate. The word "almost" is used advisedly, meaning thereby that the fit of the plate in the hole is almost snug. In most cases, however, the pocket is just a little larger. It was extremely difficult to obtain any exact measurements because of the nature

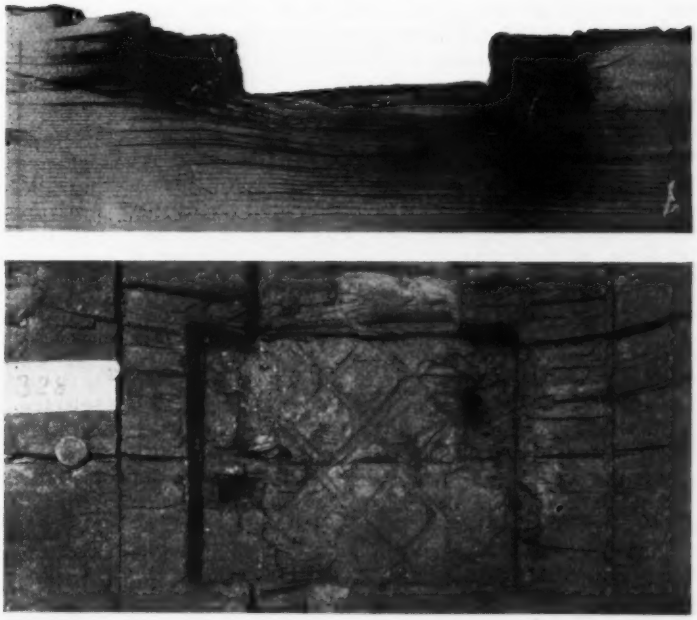


Creosoted Beech Tie, 12 Years in Service on D. L. & W., Rail Fastened with Two Screw Spikes

*Abstracted from a monograph published by the American Railway Engineering Association in Bulletin No. 306, June, 1928.

Deterioration of Ties?*

Bring About Disintegration Wood Under the Rail the Tie Plate

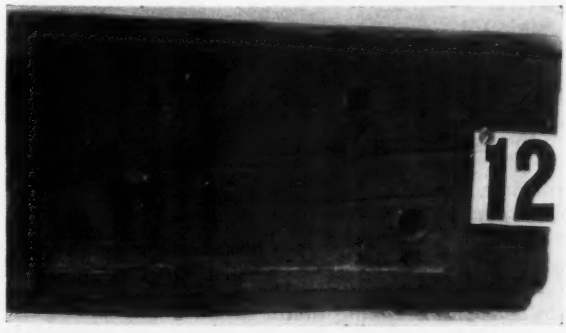


Top View and Longitudinal Section of a Douglas Fir Tie in Which Compression is Evident. Note How the Fibers Have Compressed and Bent Down Under the Tie Plate Bearing. This Has Occurred More Often in Ties Which Have a Preponderance of Springwood.

of the walls of the pocket and the disintegration of the wood at the edges of the tie plate. It may be said, however, that frequently the difference in size between the pocket and the tie plate does not exceed $\frac{1}{16}$ in., although often it is considerably more. The harder the wood, the closer fit there is.

In general, this sinking is most marked with the usual type of track construction, using cut spikes as the fastening. Where the tie plates are partially fastened to the tie, as has been the practice on the Delaware, Lackawanna & Western for some years, this sinking in of the plates is less marked. It is still less noticeable on ties on which the tie plates have been fastened to the tie independent of the rail, as on the Pittsburgh & Lake Erie.

Considering first of all the appearance of mechanically worn ties in which the rail is fastened by the use of cut spikes, it will be noted that in practically all cases, provided the plate has been in service for a sufficient length of time, the surface of the wood immediately under the plate is rough, fibrous or splintered. The extent of the splintering or shattering differs with the types of tie plates used, the kind of wood, the type of ballast and the extent of traffic. The softwoods such as pine, fir, cypress and redwood, usually sliver and splinter, whereas the hardwoods, such as red oak, beech, maple, etc., more frequently look fuzzy or woolly. In most cases, both in pine and hardwoods, groups of wood cells become separated from the body of the tie and it is comparatively easy to tear off splinters or even chips. This splintering or breaking away of masses of wood fiber immediately under the tie plate is very evident when longitudinal sections of the rail bearing are made. A study of these ties shows that this splintering goes to various depths; in some cases it is confined to the immediate surface, in other cases it may extend into the tie for ½ in. or more. In the majority of cases, however, the breaking up of the fibers is more or less a surface matter. Numerous microscopic examinations of these chips or splinters have shown that invariably they were sound wood fibers, that is, not decayed, and, that in most cases, the fibers were broken.



Creosoted Maple Tie, 12 Years in Service on P. & L. E., Tie Plate Fastened to Tie with Two Screw Spikes Independent of the Rail

Fastened or Partly Fastened Plates

Coming now to the partially fastened and independently fastened tie plates, examinations of ties with partially fastened tie plates on the Lackawanna indicate that the surface immediately under the tie plate is very much smoother than is the case under loosely fastened plates where cut spikes are used, and sections of such ties show that the splintering is confined more or less to the surface. In speaking of these partially fastened plates, particular attention is called to the round knobs of wood which project through unused holes in the tie plate. Reference to these will be made further on. An illustration is also shown of a hardwood tie on the Pittsburgh & Lake Erie in which the plates had been firmly fastened. Note particularly the smooth character of the surface immediately under the tie plate after 12 years of

service, and, in conjunction therewith, note the slight sinking in of the plate.

In order to determine the condition of the wood fiber under the tie plate, a large number of longitudinal and cross sections were made of ties in which very considerable mechanical wear was evident. Taking up some of the individual cases, a section is shown of a typical mechanically worn creosoted red oak tie which had been in service for 12 years in chat ballasted track. The maximum locomotive axle load operating over this track is 63,000 lb. and the extent of the traffic may be gaged by the fact that in 1926 approximately 5,000,000 tons passed over this particular tie. A large percentage of these badly rail worn or mechanically worn ties show no evidences of compression, as indicated by the direction of the wood fibers, when comparing the regions under the tie plate and immediately outside of the tie plate area.

In the course of these investigations, however, a number of cases were found which showed some deflection. The most aberrant of all was a creosoted Douglas fir tie, 21 years in track, with a tie plate 6 in. by 8½ in. The traffic over this particular track is estimated at about 8,000,000 tons per year with maximum axle loads of 50,666 lb. In the center of the bearing, distinct bowl-shaped chips occur which are very evident in the sectional views. In this particular case, the fibers are bent to a low point in the very center of the bearing. At both bearings, the tie apparently failed by shearing. Particular attention is called to the fact that this appears to be a compression failure and that the failure is greatest in the center of the tie plate.

This apparent compression may be due to various causes. Physically, the compression is doubtless due to the giving way of the springwood fibers which have failed by shear. When the springwood shifted laterally it resulted in a reduced volume, and this naturally allowed the stronger summerwood section to be let down, as it were, with the resultant appearance of bent lines of annual rings. It is rather striking that practically all of the cases where bending down of the annual rings was found, were in ties which had a preponderant amount of springwood. The exact explanation as to why the wood in these ties failed as it did is a rather difficult matter. Practically all show the maximum compression near the center of the tie plate, this compression being probably due to the resultant of a number of factors. It is conceivable that, with an uneven bearing, these particular tie plates were subjected to concentrated loads of locomotives and cars. Doubtless, also, there may have been a premature compression of the wood near the edges of the tie plate, due to the rocking action of the latter. This would then gradually concentrate the load into the median area of the plate which would, of course, result in increasing the concentration of load. The striking fact about this slight compression, however, is that the edges of the tie plate area are unaffected, except in one case where decay has set in and where one would naturally expect a failure of this type.

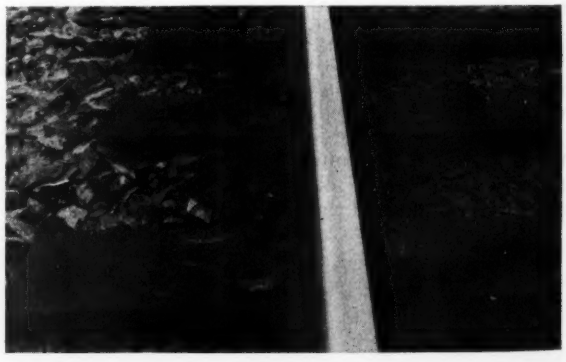
Studies of Cross Sections of Ties

It was thought that further data might be obtained from a study of cross sections of ties made through the center of the tie plate bearing area. It was very evident from a study of these photographs that there is practically no evidence of compression of the rings. What the photographs do show is that the one to two inches of wood which originally filled the cavity finally occupied by the tie plate have disappeared. The significant point is that they have disappeared entirely. The wood, in other words, has not been compressed under the tie plate during its years of service, because if it had been, this compressed wood would still be evident, particularly when viewed in cross section.

Summing up the foregoing, detailed examinations of the sections of ties through the badly mechanically worn areas show little evidence of compression or deformation. There are, undoubtedly, ties which have been stressed beyond the elastic limit, but they are apparently the exception and not the rule. The conclusion which I have drawn from this study, both of surface and of longitudinal and cross sections, is that there is little evidence of extensive compression of wood fibers.

Microscopic Studies

A number of typical mechanically worn ties were selected for a microscopic study. In each case, a typical area on the tie plate seat and a similar area in the region outside of the tie plate seat were selected. In making these microscopic studies, the ties selected were taken from three groups; first, typical ties in which the rail was fastened with two cut spikes; second, typical ties from the Lackawanna in which the rail was fastened with two screw spikes, which at the same time held the tie plate more or less firmly to the tie; and third, typical ties from the Pittsburgh & Lake Erie in which two cut spikes held the rail and two screw spikes held the tie plate entirely independent of the rail. A careful microscopic study of the structure of these badly rail worn ties can lead to only one conclusion. The wood under the tie plates, even in the worst cases, is practically normal as to the condition of the wood fiber. The changes evident are a lateral shifting of the uppermost layers. This shifting may extend down into the tie for three or four rings. It is rarely more than 45 deg. and frequently not as much as that. It is evident in oaks as well as pine. In addition to this



Standard Track Construction on the P. & L. E.

shifting, there is a breaking away of groups of wood fiber immediately under the tie plate. These groups consist of fibers which are practically unchanged as to form.

These photographs also show that the most evident shifting and breaking of the wood fibers takes place in those ties in which the most motion was possible between the plate and the wood. There is far less evidence of this shifting and shattering in the Lacka-

wanna tie plates, which were partially fastened, and practically no shifting in the case of ties from the Pittsburgh & Lake Erie in which the tie plates were independently fastened. The most striking result, in my opinion, is the finding of the shifting in the knobs of wood projecting through the tie plate in the case of the Lackawanna ties. As has been stated, these knobs were subjected to only a small compression but they were subjected to lateral stresses. If direct loading were responsible for the shifting in the direction of the wood fibers, there should have been no change of position in these knobs. The fact that the fibers were shifted indicates that other forces were at work.

Wooden Shims Reduce Wear on Ties

Some twenty-three years ago, I was struck by the practice of the French Eastern Railway, where the creosoted ties, chiefly beech, gave an average life of 30 years or more, with little, if any, mechanical wear. The engineers of this company claimed that these remarkable results were due to the fact that they had discarded or practically never used any type of metal tie plate, but were using compressed poplar wood shims as a tie protection. In 1879, this company

New Standard Track Construction on the D. L. & W.

started to use felt shims, placed between the rail and the tie. Early in 1893, in an experimental installation in the neighborhood of Paris, poplar wood shims without compression were used, and in 1903, with the invention of the compressed poplar shim, an experimental section was put in on the Paris division. By the end of 1913, the compressed poplar shim was made standard on the system and it is still so used. The shims are 4 mm., ($\frac{5}{32}$ in.) in thickness, of a width corresponding to the base of the rail, and 240 mm., (9½ in.) long. They are made of carefully selected wood and are compressed one-half. As a matter of interest, a photograph is reproduced, showing a portion of the French Eastern main line in southeastern France. The two ties with white squares are creosoted beech ties inserted in 1871, as indicated by the dating nails. They showed no evidence of any mechanical wear.

I was much impressed with this experience and I made the following statement:

"The theory upon which the use of this wooden plate is used may be briefly stated. The principal function of the plate has been said to consist of preventing the wear of the fibers of the tie immediately under the rail base. This wear consists in the actual breakage of the wood fibers under a grinding and tearing action rather than in crushing them.

"In considering the function of the tie plate we have three bodies to deal with—the tie, the tie plate, and the rail. Motion might conceivably take place either between the rail and the tie plate or between the tie plate and the tie. When a metal tie plate is used on the hardwood tie, and is successfully anchored in it, the tie plate and the tie act as one body, over which the rail moves back and forth. As soon as the tie plate loses its holding power, however, the chances are that when the rail moves across the tie the tie plate will oscillate back and forth in unison

Track on French Eastern Railway, with Wooden Shims Under Rails

with the rail. This results in breaking the wood fibers underneath the plate. Where a wooden plate is used it adheres so closely to the wood that when the rail moves across the tie the wooden plate and the wooden tie are liable to act as one, even thought the tie plate is not anchored to the tie.

"This means that any wear will probably be at the expense of the plate instead of the tie. The wooden plate is cheap, and can be replaced at no great cost. By its use the wear caused by the steel plate in the softer woods is practically entirely avoided. Ties which have been in position with these wooden plates for many years on the French roads show a most remarkable absence of wear of any sort. The wooden plates have the further advantage that they are quickly and easily applied, and that they are extremely cheap. They can, however, be used only under a fastening which holds the base of the rail strictly against the tie, such as the screw spike."

Taking all of the results of the investigations described, I am of the opinion that they point more or less to the fact that mechanical wear is due to the motion of the track parts, specifically of the rail, tie plate and tie, and that load is not the only factor.

I visualize the action of the tie plate under actual traffic briefly as follows: After insertion, particles of sand, dirt, or stone creep in between the bottom of the tie plate and the wood. This foreign matter probably acts as the abrading agent. The motion across the track and parallel to the track is probably very small. I have measured a considerable number of tie plate seats, particularly those in which the knobs of wood stuck up through the holes in the tie plate not used for spikes or screws, and find that in many of them there is a freedom of play between the knob and the edge of the hole of not more than ⅛ in., and often not as much as that. When it is remembered, however, that the diameter of vessels and wood fibers is extremely small, it will be readily seen that it takes only an infinitesimal amount of movement to extend over a considerable group of wood fibers.

Conclusions and Recommendations

It looks, therefore, as if the complex motion of the tie plate, aided by abrading materials between the plate and the wood, acting under heavy pressure is bound to destroy the wood fibers in exactly the manner in which we find them in mechanically worn ties. The rate at which this abrasion takes place will naturally depend upon a number of factors:

(1) The number and amount of impacts;
(2) The amount and kind of dirt or abrading material present;
(3) The loads exerted;
(4) The kind of wood;
(5) The type of the bottom of the tie plate; and
(6) The general character and upkeep of the track.

In presenting these conclusions and recommendations it is assumed that the track as a whole is of high standard, that is, with good ballast, good ties, properly tamped ties, and that the track has good line and surface. Provided the best conditions are maintained, an observance of the following recommendations will do much to reduce mechanical wear.

(1) Adzed and Bored Ties.—In all first-class track, only ties which have been adzed and bored before treatment should be used. The adzing gives a smooth seating for the tie plate, and to that extent reduces any irregular motion such as undoubtedly takes place in ties which have not been adzed.

(2) Canted and Cambered Tie Plates.—The use of canted and cambered tie plates will undoubtedly help in reducing the motion of the plate. With a properly designed camber and cant there is a better load distribution.

(3) Flat Bottom Tie Plate.—It must be obvious from the foregoing that the best results will be obtained where the bottom of the tie plate is free from projections, flanges or other irregularities.

(4) Size of Tie Plate.—The size of the tie plate is a vital factor. The tie plate must, under all circumstances, be large enough to give the best load distribution under any given set of circumstances. Under heavy traffic, no tie plate should be less than 7½ in. in width, and the length and thickness should be proportioned to the traffic demands.

(5) Independently Fastened Tie Plates.—The most promising factor in reducing mechanical wear is doubtless connected with the fastening of the tie plate to the tie independent of the rail. Many details will doubtless have to be worked out to develop an ideal fastening. This ideal fastening should be simple, easily applied, easily repaired in case of accidents or wrecks, and above all, demand low maintenance expenditure.

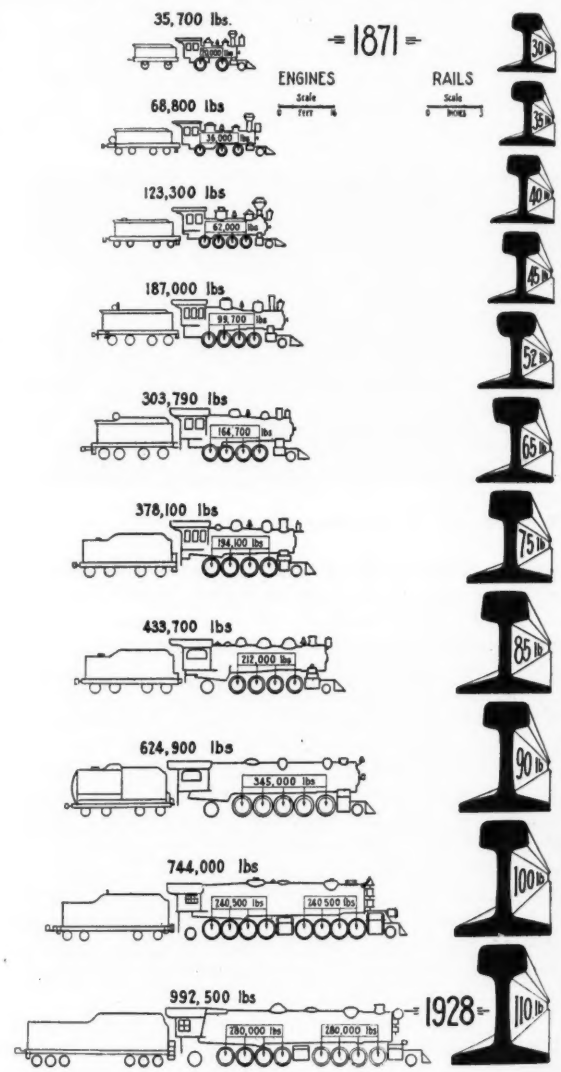
(6) Replacement of Plates.—At the present time, whenever rail changes are made, and particularly when new plates are laid, either of different design or of larger size, it is customary to adze the ties by hand. This results in much waste of wood and frequent exposure of untreated wood, with consequent loss of decay protection. One of the most practicable remedies for this matter is the Neafie tie scoring machine, which saws an even cut without waste of wood, and enables the track operator to secure a smooth, even bearing.

(7) Wooden Shims.—When first introduced the wooden shim was regarded as a possible substitute for the metal tie plate. This has given rise to much misconception. In France and Germany where the screw spike is used as a standard rail fastening, it is possible to insert wooden shims and to replace shims broken or otherwise destroyed with ease and rapidity. The pressure of the screw holds the shim in position. It is probable, with our present cut spike fastening, that the wooden shim alone will serve only as a temporary expedient, if at all, in reducing mechanical wear. The cut spike fastening, furthermore, does not permit easy renewal of the shims where they creep out or are destroyed.

(8) Future Developments.—It should be understood that the matters discussed in this investigation are largely of a fundamental nature. If it is once understood what it is that must be solved, a better point of attack is presented. It is felt that if the motion of the tie plate is responsible for the destruction of the ties, this gives a basis for further study and development. It is believed that with the track experiments already initiated, and with others still to be devolped, the mechanical life of creosoted ties may be considerably extended, with a consequent large saving.

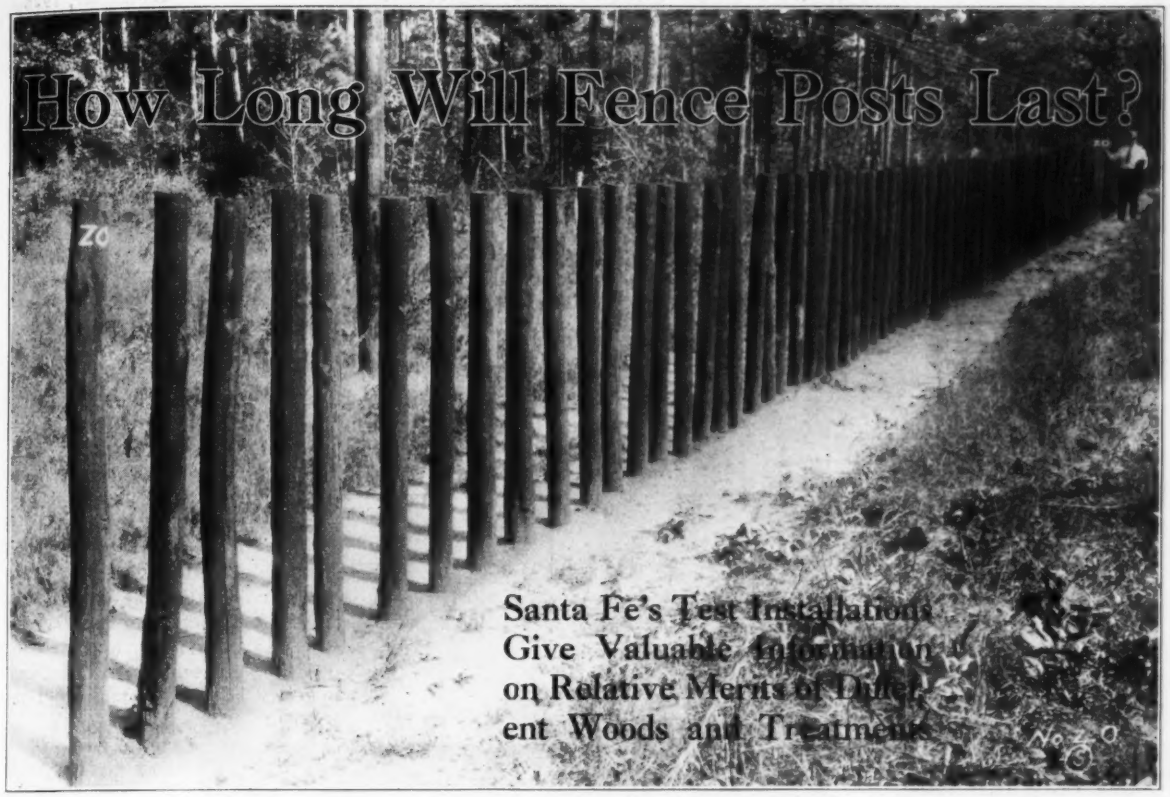
57 Years of Progress

UNDER the above heading the Denver & Rio Grande Western has prepared a comparison of the development of its locomotives and its rails from 1871 to date, as shown in the accompanying cut. Starting with a 3-ft. gage and 30-lb. rail, the lightest



One Road's Development in Locomotives and Rails in 57 Years

ever used for transcontinental traffic, its standards of track construction have been raised by successive degrees to the 110-lb. rail now being laid. Likewise the locomotives have grown from a gross weight of 37,500 lb. in 1871 to 992,500 lb. in 1927.



A Zinc and Oil Emulsion Was Used in 95 Yellow Pine Posts Placed in 1926

IN OCTOBER, 1913, the Atchison, Topeka & Santa Fe inaugurated a test of southern yellow pine fence posts along its right of way at Cleveland, Tex., for the purpose of obtaining comparisons of the life of untreated posts with those treated by various preservatives as well as by different processes. In all 214 posts were set, 15 of these being untreated, to serve as a measure of the efficiency of the different preservative treatments which were being tested. Since 1913, other posts have been installed, these including 141 southern pine and 30 red oak posts installed in 1918, 21 southern pine and 59 New Mexico red spruce posts placed in 1922, and 331 southern pine posts placed in 1926, these additions bringing the total number of test posts to 796. Inspections of the posts were made in December, 1916; November, 1919; November, 1920; December, 1921; May, 1924; January, 1926; and October, 1927. At each inspection, the condition of each post was noted and recorded so that a complete history of all the test posts is available. The record is supplemented by photographs of the posts remaining in each group at the time of inspection.

Various Preservatives Used

The preservatives used included creosote and zinc chloride as well as a number of other materials. Various methods of treatment were also employed, ranging from a simple painting to a full-cell pressure treatment in the case of coal-tar creosote.

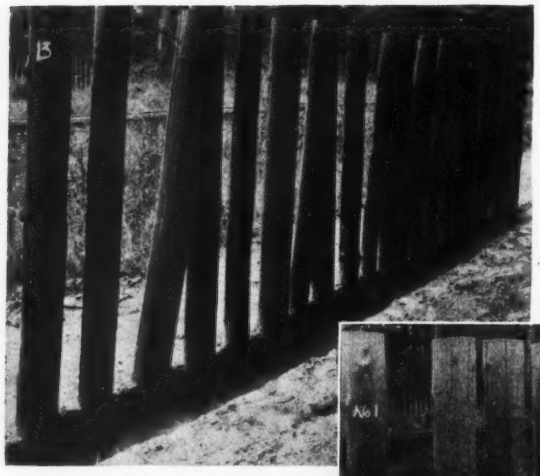
By 1916 the 15 untreated control posts were badly decayed at the ground line, with some fungi above the ground, and at the November, 1919 inspection, they were all rotted off.

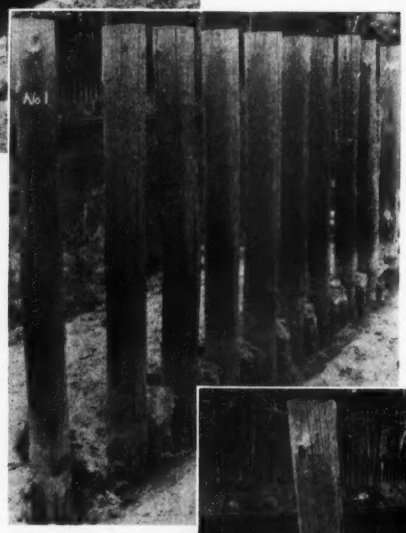
The 17 posts treated with German creosote by the full-cell process, with an average absorption of 34.52 lb. per cu. ft., were still in excellent condition at the time of the 1927 inspection and showed no evidence of decay. Twenty-two posts treated with German creosote by the Rueping process also showed good results, but not equal to those treated by the full-cell process. At the 1926 inspection all of these posts were in excellent condition, showing no evidence of decay, while at the 1927 inspection, 12 of the posts were sound and 10 were slightly soft on the outside below the ground line.

The Record of the Zinc-Treated Posts

Posts treated with zinc chloride by the open tank process also showed good results, 11 posts treated with a 4.5 per cent solution, with an average absorption of 1.28 lb. of dry zinc chloride per cu. ft., being in excellent condition at the 1927 inspection. Another group of 10 posts treated by the same method, with a 2 per cent solution of zinc chloride and an average absorption of 0.471 lb. of dry zinc chloride per cu. ft. were all in excellent condition in 1919, while in 1920 and 1921, all of the posts were in good condition, except one, which was somewhat rotten at the ground line in 1920 and which had rotted off by May, 1924. In 1926, of the remaining nine posts, six were in good condition, two were slightly decayed below the ground line and one was decayed below the ground line to a depth of ½ in. In the following year, four of the posts were still in good condition, four were slightly decayed at the ground line and one was decayed below the ground line.

Thirty-eight of the posts installed in 1913 were treated by the open tank method with antinonnin solutions of different intensities. Of these posts, 13 were treated with a 0.5 per cent solution, with an absorption of 11.17 lb. of the solution to the cubic





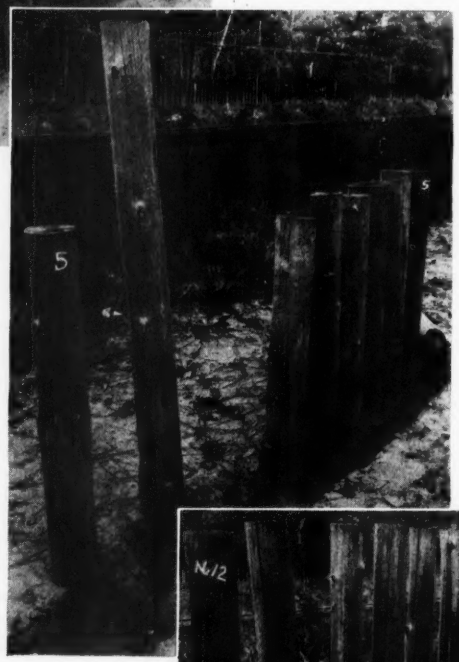
Above — Condition of Posts 14 Years After Treatment with Creosote by the Rueping Process

At Right — Posts Treated with 1.28 lb. of Zinc Chloride per Cubic Foot Were Sound 14 Years After Installation

foot, and 12 were treated with a 0.25 per cent solution and an absorption of 14.39 lb. of the solution per cubic foot. Those treated with the 0.5 per cent solution were badly decayed at the ground line in 1916, and in 1919, all were out except two, which were rotted, and which were out at the 1920 inspection. Of the 12 posts treated with the 0.25 per cent solution, all but one were decayed at the ground line at the end of three years, and in 1921, only three remained standing, and they were decayed so that they were held up only by the heartwood. Thirteen posts, treated with a 0.12 per cent solution of antinonnin and an average absorption of 24.59 lb. per cu. ft., were badly decayed at the ground line in 1916, while the 1924 inspection found only two of these posts standing, the others having rotted off at the ground line, with the wood above the ground line fairly sound. These were trimmed and reset, but as they again showed decay below the ground line in 1926 and 1927, the test was considered closed.

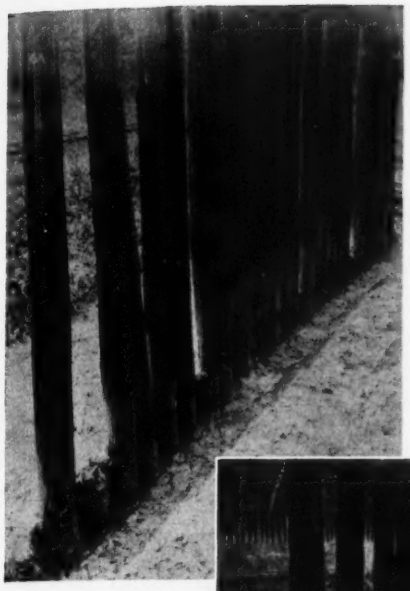
A total of 27 posts placed in 1913 were treated with solutions of sodium silico fluoride by the open tank process, a two per cent solution, with an average absorption of 9.46 lb. per cu. ft., being used for 14 of the posts, while the remainder were treated with a one per cent solution and an absorption of 21.03 lb. per cu. ft. Of the former group, all had begun to decay in 1919, while in 1927, 11 posts were still standing but were badly decayed, being held up only by a small amount of heartwood. Those treated with the one per cent solution had begun to decay in 1919, and while all the posts were standing in 1927, they were badly decayed.

Seventy-four of the posts installed in 1913 were painted with various materials. German creosote was used on 14 of these posts; Lyster wood creosote on 15; R. I. W. on 3; Locustine on 15; Reeves Wood Preserver on 6; Barrett's creosote on 6 and Carbolineum on 15 of the posts. All of the posts painted with German creosote, Lyster wood creosote, R. I. W. and Locustine showed decay in 1916 and all but one were out at the 1920 inspection, and it had failed by the following year. Of the six posts painted with Barrett's creosote, five were out before the inspection in 1919 and the remaining post had failed before the 1921 inspection. In 1916, 9 of the 15 posts painted with Carbolineum were in good condition, 5 were slightly decayed at the ground line, while 1 was badly decayed at the ground line, with much fungi above the ground. In 1919, 3 posts were out and the others were rotting at the ground line. In 1924, all but 1 of the posts had rotted off and fallen over, while the remaining post was rotten at the ground line, and in the sapwood above ground. In January, 1926, this post was still standing, but



Left — Posts Treated with a 0.12 Per Cent Solution of Antinnonin Were Badly Decayed in 14 Years

At Right — Posts Treated with a 2 Per Cent Solution of Sodium Silico Fluoride Were Badly Decayed at the Ground Line in 1927



Above — Posts Treated with 0.887 lb. of Copper Sulphate to the Cubic Foot, After 9 Years' Service

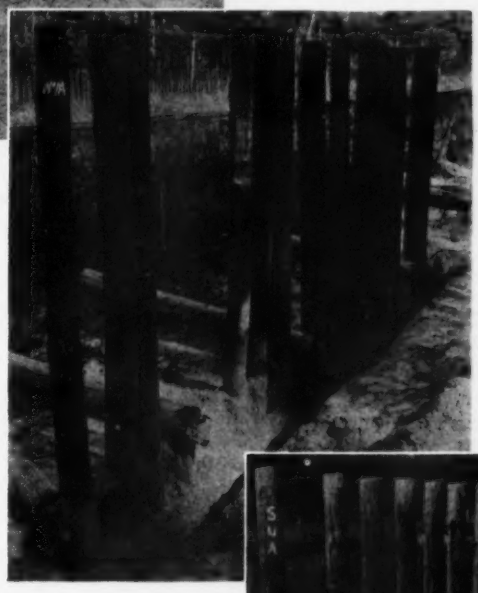
Right—New Mexico Red Spruce Post Treated with Creosote by the Rueping Process

oak posts, treated in the same way, with from 0.346 to 1.422 lb. to the cubic foot, showed the same checking and splitting as the pine posts, and while 18 of the posts were still standing in 1926, the test was closed in that year.

On March 23, 1922, 25 New Mexico red spruce posts, treated with creosote by the Rueping process, with a net retention of 5.18 lb. per cu. ft., were installed, and all were in excellent condition in October, 1927. Another lot of 23 posts of the same timber, treated by the Rueping process, with a retention of 2.68 lb. of creosote to the cubic foot, installed in March, 1922, were all in excellent condition in January, 1926, while the inspection in October, 1927, disclosed that 5 of the posts showed slight decay below the ground line.

Eleven New Mexico red spruce posts treated with zinc chloride by the pressure process were also installed in 1922. Four of these posts, with 0.975 lb. of dry zinc chloride per cu. ft., were in excellent condition in January, 1926. In October, 1927, two of the posts were still sound and the other two were slightly decayed at the ground line. Seven of the posts, with 0.47 lb. of zinc chloride per cu. ft., were in excellent condition in May, 1924, while in January, 1926, two of them were soft at the ground line. At the inspection made in October, 1927, four of the posts were slightly decayed at the ground line and the remainder were sound.

Twenty-one southern pine posts, treated by the Sucher process in an open tank, were placed in 1922. The penetration of the preservative, which consists in the main of pine tar, was very poor, being scarcely more than on the outside and within was badly decayed and the test was considered closed.



Above—Of 21 Posts Treated by the Sucher Process and Placed in 1922, 17 Were in Very Good Condition in 1927

Right—Twenty Yellow Pine Posts Treated with Molten Sulphur Were Installed in 1926

Later Installations of Test Posts

Thirty-one southern pine posts treated with copper sulphate by the open tank process, with an absorption of 0.887 lb. of dry sulphate to the cubic foot were placed in February, 1918. The inspection in May, 1924, showed that all of the posts were considerably checked and there were indications of separations of the annual rings in the sapwood. Two posts had rotted off at the ground, 11 were decayed below the ground line and the remainder were in good condition, except for the checking referred to. In October, 1927, five posts had broken off at the ground line, 18 were badly decayed, 4 were beginning to decay at the ground line and 1 was decayed above the ground line, leaving 3 posts in good condition.

One hundred and ten southern pine posts, treated with ferrous chloride by the pressure process and with from 0.479 to 2.37 lb. of dry ferrous chloride to the cubic foot, were installed in 1918. In May, 1924, all of these posts were so badly checked and split that, regardless of any preservative value of the ferrous chloride, it would have been difficult to keep staples in the wood. All of the posts were badly decayed at the ground line. In January, 1926, 55 of the posts were still standing, but were in such poor condition that the test was closed. Thirty red

Condition of Posts at Various Inspections

Date Installed	No. of Posts	Treatment	Process	December, 1916 Sound	Decayed	Out	November, 1919 Sound	Decayed	Out	December, 1920 Sound	Decayed	Out	December, 1921 Sound	Decayed	Out	May, 1924 Sound	Decayed	Out	January, 1926 Sound	Decayed	Out	October, 1927 Sound	Decayed	Out	Remarks
Oct., 1913	15 Y.P.*	Untreated			15				15																Test closed in 1919
Oct., 1913	17 Y.P.	Creosote	Full-cell	17			17			17			17			17			17			17			In excellent condition, 1927
Oct., 1913	22 Y.P.	Creosote	Surging	22			22			22			22			22			22			22			In excellent condition, 1927
Mar., 1907	46 R.O.	Creosote	Surging													46			46			43	6		Slight decay in five posts in 1927
Oct., 1913	21 Y.P.	Zinc chloride	Open tank	21			21			20	1		18	1		20		1	17	3	1	16	5	1	Slight decay in five posts in 1927
Mar., 1922	11 R.S.	Zinc chloride	Pressure													11			9	5		6	5		Slight decay in five posts in 1927
Oct., 1913	13 Y.P.	Antimonio solution, 0.5%	Open tank		13			13			2	11			13										Test closed, 1921
Oct., 1913	12 Y.P.	Antimonio solution 0.25%	Open tank	1	11			8	4		7	5		3	9		1	11		1	11				Test closed, 1926
Oct., 1913	13 Y.P.	Antimonio solution 0.12%	Open tank		13			13			13			13			2	11		2	11		2	11	Test closed, 1927
Oct., 1913	27 Y.P.	Sodium silico fluoride	Open tank	23	4			27			27			27			26	1		24	3		24	3	All badly decayed at ground in 1927
Feb., 1918	21 Y.P.	Copper sulphate	Open tank													16	15		14	13	4	3	13	5	15 posts badly decayed in 1927
Feb., 1918	20 R.O.	Ferrous chloride	Pressure														20			18	12				Badly checked and split, test closed, 1926
Feb., 1918	12 Y.P.	Ferrous chloride	Pressure														12(a)			7	7				Badly checked and split, test closed, 1926
Mar., 1922	21 Y.P.	Luther process	Open tank													21			21			17		4	17 posts in very good condition in 1927
Oct., 1913	14 Y.P.	Germon creosote	Painted		14			12	2			14													Test closed, 1926
Oct., 1913	16 Y.P.	Igster wood creosote	Painted		15			2	13		1	14			15										Test closed, 1921
Oct., 1913	8 Y.P.	H. I. W.	Painted		5			3				5													Test closed, 1926
Oct., 1913	16 Y.P.	Locustine	Painted		15			1	14			15													Test closed, 1926
Oct., 1913	6 Y.P.	Reeves Wood Preserver	Painted	6			6			5	1		5	1		5	1		5	4		2	4		
Oct., 1913	6 Y.P.	Barrett's creosote	Painted		1	5		1	5		1	5			6										Test closed, 1921
Oct., 1913	15 Y.P.	Carbolineum	Painted	9	6			12	3		10	5		8	7		1	14		1	14		1	14	Standing post badly decayed in 1926
Mar., 1906	80 Y.P.	Molten sulphur	Pressure																			80			In excellent condition in 1927
Mar., 1906	140 Y.P.	"X" - petroleum	Pressure																			140			In excellent condition in 1927
Mar., 1906	95 Y.P.	Zinc-oil emulsion	Pressure																			95			In excellent condition in 1927
Mar., 1906	76 Y.P.	As-sol solution	Pressure																			76			In excellent condition in 1927

*Kinds of wood indicated as follows: Y.P., southern yellow pine; R.S., New Mexico red spruce; R. O., red oak

Tabulated Results of the Fence Post Tests

the checks. The absorption of the liquid per cubic foot ranged from 1.25 to 5.45 lb., with an average of 3.17 lb. The posts were very sticky for some time after treatment. Subsequent inspections showed that all of the posts were in excellent condition in January, 1926, although four were down in October, 1927, with the others in good condition.

More recent installations of southern yellow pine test posts were made in 1926, including 20 posts treated with molten sulphur, by the pressure process, 140 posts treated with an "x"-petroleum mixture, 95 posts treated with an emulsion of zinc chloride, Mexican residuum and Mexican distillate, and 76 posts treated with an AC-Zol. solution. All of these posts were in excellent condition in October, 1927, but the tests had not progressed sufficiently at that time to furnish any definite conclusion.

A tabulation is presented herewith showing the condition of the posts at the various inspections, the posts being segregated by dates of installation, kind of wood and method of treatment, from which the results may be compared easily. It is interesting to note that all of the posts treated with creosote and placed in 1913 were in excellent condition 14 years after being installed, and that of the 21 posts treated with zinc chloride by the open tank method, 15 were in good candition, 5 were slightly decayed and only 1 was out in 1927. On the other hand, it will be noted that of the 74 posts painted with various preservatives and placed in 1913, only 15 were sound in 1916, while 54 were decayed and 5 were out. In 1921, the inspection of this group disclosed 5 sound and 9 decayed posts standing, with 60 posts out.

Cleveland, where these tests are conducted under the charge of R. S. Belcher, manager of treating plants for the Santa Fe, is located in southeastern Texas. The rainfall in this region is heavy, and this, combined with other climatic conditions, is conducive to the rapid decay of timber.

The Wishing Habit

Those of us who still remember the fairy tales we learned when we were small - not the kind we have since learned to tell our wives - will recall the story of the adventures of a young Arab sheik, named Aladdin, who was the owner of a wonderful wishing lamp, which, when massaged with the proper hocus-pocus and incantations, would satisfy the owner in any wish he might make.

Recent scientific research has developed the fact that Aladdin was the first track man; which makes him the grand-daddy of us all. True, he roamed the earth a long time before there were any railroad tracks; but just as Tubalcain is the forefather of the blacksmiths, so Aladdin with his wishing lamp, is the progenitor and patron saint of all track men.

Many of us have inherited the wishing habit from this famous ancestor, although our wishing in these modern times is nearly always practiced without using the mysterious ceremony of rubbing the lamp. We wish that we might get our bolts tight and our track spotted up, our ditches cleaned and our ballast dressed, our fences built and our rail set up; and then, having performed the ceremony, we light our pipe and sit back to wait for a divine providence to drop these blessings into our lap, wrapped and sealed and tied with a blue ribbon.

Thus far, wishing itself, hasn't been much of an asset in running a section. Of course it is just possible that when we caress our wishing lamp we do not have sufficient faith in our wish coming true. In this connection however, there comes to mind another gem of literature - and this is not a fairy tale - which says something to the effect that faith without works is nothing.

Some fellow wrote a song about "I wish I had the wings of an angel" but there is no record of his ever doing any flying. Another fellow came along with a kit of tools and a disposition to work, and invented the aeroplane. He flew.

It is mighty fine to wish for big things; usually this is necessary before results can be accomplished. But when wishing it is much better to do it bending over so as to keep the sweat out of your eyes than to lie on your back and gaze at the stars.

P.S. If you were told to order a set of switch ties by pieces, could you do it? Page 128 Book of Rules gives the information.

White Elephants

A certain ladies' club arranged for a "White Elephant Party" at which each member was asked to bring to the party something that was no longer of any use to her but which, for sentimental or other reasons, she did not wish to throw away. Thirteen members brought their husbands; the other three were not married.

Not a few of us are white elephants, not only to our wives but also to our bosses. We have been reasonably useful in times gone by but at the present time we do not fit in with the general scheme of things because we have lost the desire to co-operate and follow instructions.

It is not unusual for a roadmaster to say about one of his foremen, "I don't know how many times I have told that fellow to do so and so but I can't get him to do it." Then when the roadmaster's patience is exhausted and he gets emphatic about his requests you think he is hard boiled and trying to run you off the job. And you get to working at cross purposes with the boss and the railway suffers.

You have had men in your gangs who, when told to do a certain job a certain way, try to do it some other way or do a lot of belly-aching or otherwise fail to enter into the spirit of the work. It is pretty hard under such conditions to feel very kindly toward such a man, even though you know he is capable.

As for trying to run a man off the job, there are few cases where the boss follows such a policy. There are none of us who could not be discharged for good cause every day if our superiors were disposed to follow up our shortcomings. A lot of us are left on the job because the boss still has hopes of being able to get us to do the right thing.

Some fellows get the idea, when a new boss comes on the job, that he is going to clean house and put some of his own favorites in place of those now working. This is a mistaken idea; there are mighty few men working for the railroad today that follow such a policy, and where such cases exist there is someone else on the job to block such a plan. A new man naturally has some new ideas but as long as he is the boss there is no reason why his instructions should not be observed. You owe it to him to give him your ideas but after you have done this, the responsibility for the instructions is his and it is up to you to follow them.

We are living in a free country; we are at liberty at any time to turn our job over to some one else, but as long as we are on the job it is our duty to follow our instructions; and in doing this we should try to see not how little, but how much we can do to avoid violation of these instructions.

How One Division Engineer Talks With His Men

Two more examples of the monthly bulletins sent to all foremen and men on the Northern division of the Frisco

Three Stages in the Life of a Viaduct

The Top View Was Taken in 1884 When the Timber Trestle Was Being Replaced. The Middle and Lower Views Show the Iron and Steel Viaduct Before and After the New Trusses Had Been Erected.

Last Change in Northern Pacific Bridge Involved Replacement of Truss Spans and Called for Ingenious Erection Procedure

By L. B. CURTISS
Resident Engineer,
Northern Pacific

AN INGENIOUS erection plan employed in renewing truss spans on a viaduct 226 ft. high, lends interest to the strengthening of Marent viaduct on the main transcontinental passenger line of the Northern Pacific west of Missoula, Mont. When this road was located through the Rocky mountains, it followed the Missoula river and its tributaries from the summit of the continental divide at Blossburg, Mont., to Missoula. Beyond this point the rough, preciptous banks of the Missoula river appeared, in the days before the steam shovel, to be insurmountable and the engineers selected what seemed to be a more feasible rout over a spur of the Rocky mountains known as the Coriacan defile. This line leaves the Missoula valley 10 miles west of Missoula and climbs on a grade of 116 ft. per mile for a distance of 10 miles to the summit. Seven miles up this ascent it crosses Marent gulch on a steel viaduct, 796 ft. long and 226 ft. high.

The characteristics of the various structures which have served at this location, are as follows:

(1) A timber viaduct, 886 ft. long and 226 ft. high, designed for a load equivalent to Cooper's E 24, built in 1883.

(2) An iron and steel viaduct, 796 ft. long and 226 ft. high, designed for Cooper's E 28 loading, built in 1884.

(3) The towers and floor systems of the trusses of these were strengthened in 1904.

(4) The trusses were replaced by new trusses in 1927 and the structure now permits the operation of a locomotive equivalent to Cooper's E 65.

Many years after the first line was built, as more modern construction methods came into use, a second line was built west from Missoula along the Missoula river, rejoining the original line at Paradise. This line, completed in 1909, is 29 miles longer than the first, but, because of easier grades, is used for all freight trains.

The original viaduct, begun on December 26, 1882, was, when built, the highest wooden trestle in America. It consisted of eight wooden towers, 20 ft. long parallel to the bridge and of various heights to suit the ground, supporting seven 50-ft. Howe truss spans. The timber which went into the original structure, amounting to 1,004,000 ft. b.m., was cut from the surrounding hills within a radius of five miles of the structure. The 58 tons of iron, used in its construction came by rail from Portland to the end of the existing track, from which point it was hauled by team to the bridge site over 80 miles of difficult roads. June 15, 1883, the day on which the completed bridge was crossed by the track, was made a festive occasion by the entire country around, many of the inhabitants seeing a locomotive for the first time.

Wooden Viaduct Replaced in 1884

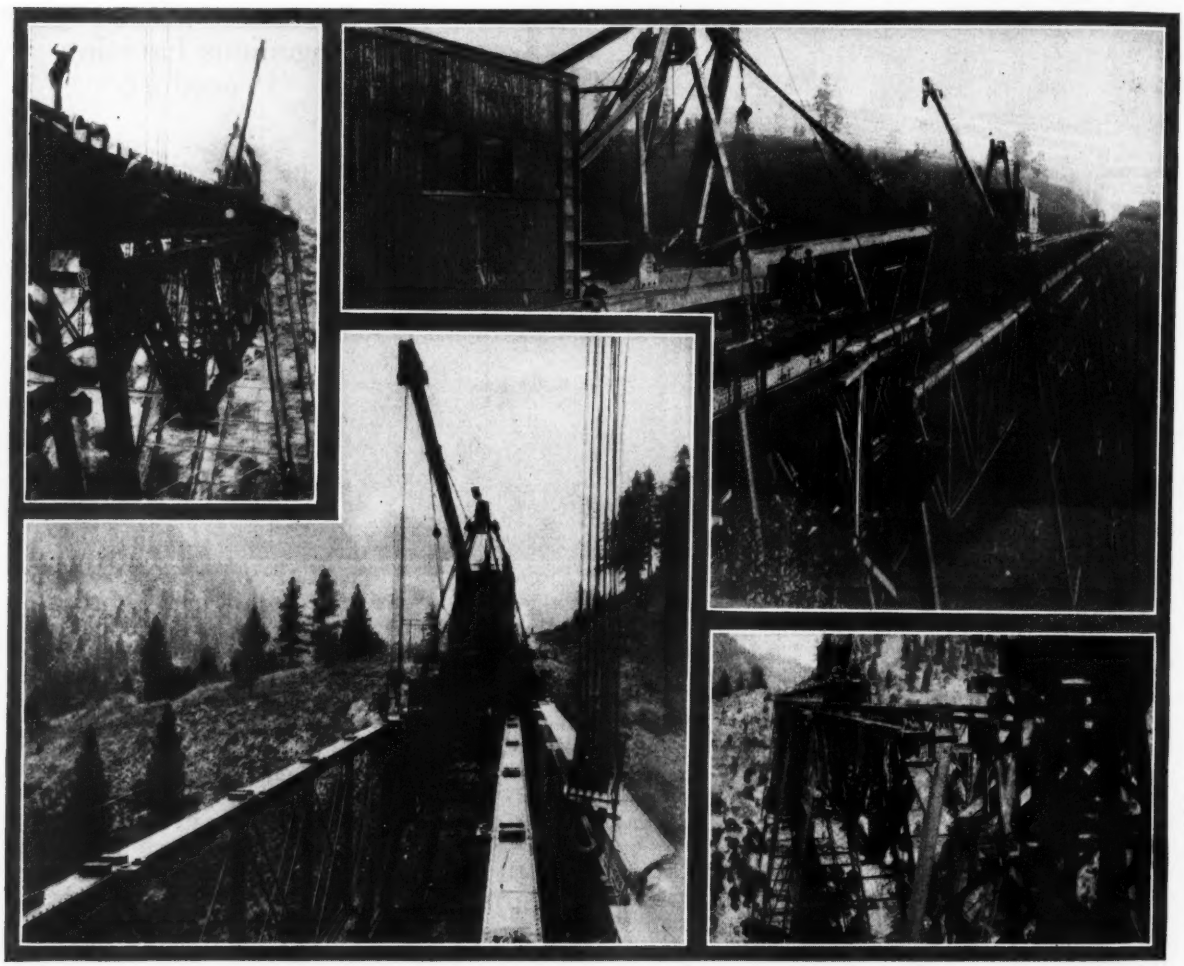
In spite of its height, the wooden structure remained in good order, but much uneasiness was felt by the railroad officers because of the constant danger from fire and the very serious interruption to traffic which might result therefrom. In 1884, a new structure was designed by George S. Morison, the construction of which was placed in charge of Alfred Noble. The

iron viaduct was so designed that it could be erected on the line of the trestle, and the existence of a structure at the site, from which the new one could be erected, made it economically possible to use longer spans and fewer bents than is usual in viaducts, the distance between the centers of the iron towers being twice that between the wooden ones. These long spans, however, made the later changing out of the trusses more difficult than in the ordinary type of viaduct.

The iron structure was completed in April, 1885, and consisted of five 116-ft. 8-in. pin-connected deck trusses, with two 30-ft. deck plate girders at each end, supported on four towers, 23 ft. 4 in. across the top in crossing the bridge and many of the others were restricted to slow speed. In order to provide for these heavier locomotives and for higher operating speeds, it was decided, early in 1927, to erect new steel trusses and approach girders. The new riveted trusses are of the same general form as the old ones and are designed for Cooper's E65 loading, in accordance with the Northern Pacific standard specifications.

Heavier Trusses Required Careful Handling

The problem of placing the new trusses was one to which much study was given. The height of the viaduct precluded the placing of falsework to support the



Four Views of the Erection Procedure Showing Sequence of Operations

line with the bridge, four bents and two masonry abutments. The length of this bridge was 796 ft. 8 in. Two piers at the bottom of the ravine rest on pile foundations, driven to rock; the remaining piers and the abutments rest on bed rock. The track on the bridge is on a 1.96 per cent grade.

In 1904, the increasing train loads made it necessary to reinforce the tower columns and bents and the floor system of the trusses. This was accomplished by placing additional plates and angles on the column sections and by adding extra material to the flanges and webs of the members of the floor system.

During recent years, the heavier locomotives now in use on the main line had been prohibited from spans during the change and it was impracticable to lift the trusses into position from the ground. The time element, also, was important, for although the through passenger trains could be detoured over the freight line, it was necessary to provide for local trains six days each week. Each truss weighed 48 tons so that it was impossible to handle them from one end with a single derrick.

The plan of erection adopted provided for temporary steel brackets on the outside of the tower columns, near the top. After being assembled and riveted, each truss was carried on car trucks by two derricks to its position on the bridge, swung out beyond the old truss and lowered to these brackets. In order to keep the side

swing of the derricks to a minimum, the trusses were placed on the temporary brackets on the side of the bridge opposite their final position, thus permitting the new trusses, with their lateral plates extending out from the center of the bridge, to be set close to the old trusses. The center of the bearings on the temporary brackets was 13 ft. from the center of the track.

After the new trusses were placed on the erection brackets, the deck and floor system of the old span were removed, working from the center toward each end and the truss lateral bracing was also removed. The old truss at the left was lifted from its position on the column, swung toward the center of the bridge, and lowered so that it rested on the top cross struts of the tower, when the new truss on the right hand brackets was lifted, swung over and lowered to the column caps just vacated. The old right hand truss was then moved from its position and lowered to the right hand brackets from which the new truss had been taken. The new truss on the left brackets was then moved to its final position on the right of the bridge and the old truss, which had been resting on the tower struts, was carried out to the left hand brackets. The new floor system could now be placed. When the new deck was completed, the old trusses were lifted from the erection brackets and carried from the bridge. These operations were repeated for each truss span. Each change was made in about one and one-half days.

To guard against any possibility of tipping, the derricks were blocked and wedged tightly at each corner and also tied down to the old structure with cables. Six-sheave blocks were used so that the movements of the trusses could be controlled accurately and the two derricks operated in perfect unison. As the old tower stringers rested on top of the end floor beams of the old trusses, these had to be removed or blocked up temporarily on the top struts of the tower before the old trusses could be taken out. This necessitated keeping the derricks back of the towers during the changing-out operations.

The reconstruction of the viaduct was carried out under the direction of the engineering department of the Northern Pacific: H. E. Stevens, chief engineer (now vice-president in charge of operation); M. F. Clements, bridge engineer, and the writer. The new structural steel was furnished by the American Bridge Company and the Industrial Contracting Company, Minneapolis, Minn., had the contract for erection.

Keeping Equipment Busy

By J. R. Watt

General Roadmaster, Louisville & Nashville, Louisville, Ky.

THE ECONOMY in the use of labor-saving equipment is well established, but the extent of the saving is dependent on the use made of the equipment. In general, the successful operation of any kind of machinery requires close supervision to keep the machine assigned where it is needed and will be kept in operation as well as to keep it in good operating condition.

It is sometimes easier for those in direct charge of work to permit it to go along in the old fashioned way, for the proper use of equipment involves making a program in order to keep work ahead of the machine. This is particularly true of pile drivers, concrete mixers and air compressors, including paint spraying machines, which may sometimes be held at one point to be used a little later, while closer supervision would result in moving them to other points for immediate use.

Experience has shown us that tie tamping outfits will not be used much in what we call our Northern territory after October 30. The outfits therefore, can be sent south at that time and returned in time to allow for some inspection and repair before April 1.

An effort is made to keep the data regarding the work performed in as simple a form as possible, and, at frequent intervals, the figures are sent out to all concerned for study and comparison. As an indication of the information kept on air compressors, a statement of the operation of air compressors for the months January to April, inclusive, 1928, is shown here.

An important feature in the successful operation of air outfits, in whatever service, is good tools. An air tool will continue to operate long after it is worn to the point where it should be repaired or replaced, but

Div.	No.	Size	Gal. Gas	Miles Track	Hours	Gal. per hour	Remarks
Nash.	150	5 x 5	654	4.2	390	1.7	
N. L.	151	5 x 5	486	5.3	394	1.2	
N. L.	152	5 x 5	557	6.0	453	1.2	
N.& N.	153	5 x 5	503	6.0	340	1.5	
K. D.	154	5 x 5	421		387	1.1	Drilling
Sham.	155	5 x 5	602	7.0	434	1.3	
N.O.&M.	156	5 x 5	815	8.0	654	1.2	
L.C. &L.	157	5½x 5	431	1.8	259	1.7	Drilling
M.&M.	158	5½x 5	860	4.9	437	2.0	
L.C.&L.	159	5½x 5	295		176	1.6	Drilling
M.&M.	160	5½x 5	365	2.0	144	2.5	
H.D.	161	5½x 5	373	3.7	196	1.9	
Lou.	162	5½x 5	304	2.4	198	1.7	
Nash.	163	5½x 5	772	6.3	479	1.7	
Lou.	164	5 x 5	387	4.4	200	1.2	
Ky.	165	7 x 6	1,350		540	2.5	Drilling
Lou.	166	7 x 6	731		408	1.5	Drilling
Sou.	167	7 x 6	675	4.7	308	2.2	
Nash.	168	7 x 6	1,521	9.0	501	3.0	
N. L.	169	7 x 6	1,193	9.0	396	3.0	
N. D.	170	5½x 5	559		380	1.5	Drilling
N. K.	171	5½x 5	440	2.5	245	1.8	
Sham.	172	5½x 5	322	4.0	310	1.7	
N.O.&M.	173	5½x 5	785	8.0	455	1.7	
K.D.	174	5½x 5	210	2.4	151	1.4	Apr.
L.C.&L.	176	5½x 5	104	1.0	78	1.3	15 days

Test of Compressors With Nozzles and Lubricators

obviously in such cases its operation is unsatisfactory, both in the reduced force of the blow and the waste of air. Sometimes the speed of compressors has been increased to take care of this waste.

Test nozzles of correct size can be substituted for a given number of tools, and the operation of the compressor noted. If the compressor keeps up the required pressure with the test openings, but does not handle the tools satisfactorily, the trouble is evidently in the tools. Some regrinding of tools has been found economical. Suitable lubricators will be found useful, not only for feeding a small supply of alcohol to the tools in cold weather, but for providing better lubrication for the tools at all times.

Adequate supervision of the equipment itself is important, for it is very discouraging to accumulate forces to do certain work and then to have the equipment fail. This one thing has been responsible for the failure of some supervisory forces to take labor-saving equipment willingly and push its operation. In order to eliminate expensive delays, it pays to buy well-built equipment and to take the necessary steps to keep it in good operating condition.

From our own experience, much can be accomplished by accepting the service which is furnished gladly by most manufacturers; for the service man, being a specialist, can give valuable instructions to the maintenance force employed by the railroad. Manufacturers are willing to do this in order to keep themselves advised as to the service rendered by their equipment, as well as keep themselves posted on possible developments.

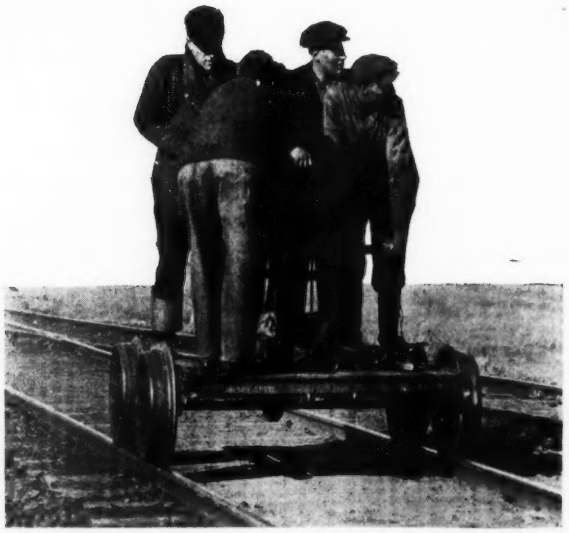
A close check on the performance of each machine is helpful, not only to stimulate interest in the amount of work accomplished, but to check the amount of gasoline consumed and other items of expense.

Taking the Slack Out of Motor Car Operation*

A Statement of the Measures That a Foreman Can Take to Increase Efficiency and Reduce Accidents

By C. R. KNOWLES

Superintendent Water Service, Illinois Central, Chicago



THERE ARE about 60,000 track motor cars in service on the American railroads today, representing an investment of between $12,000,000 and $15,000,000. The cost of operating and maintaining these cars aggregates more than $6,000,000; including interest and depreciation charges, based upon a five-year life for the cars, the total annual cost is about $10,000,000. About 40,000 of these cars are used in maintenance of way work and it is with the operation and maintenance of these cars that we are chiefly concerned.

There is no question regarding the value of the motor car as a maintenance of way tool if it is properly operated, for it is easy to effect a saving far in excess of its cost of operation and maintenance. If, however, the car is operated in such a manner that it requires excessive maintenance, or an accident occurs, it becomes a liability instead of an asset.

The two things that retard the universal adoption of motor cars are the excessive maintenance costs due to careless operation, and accidents. Following an epidemic of motor car accidents I recently heard the chief operating officer of a large railroad express himself in favor of going back to the hand car as a less expensive and safer tool than the motor car. It is up to you foremen to so utilize the motor car as a maintenance tool as to secure the maximum economy and safety.

The Foreman's Responsibility

As foremen in charge of motor cars, you should have a definite understanding with each man in your gangs as to the part he is to take in handling the car if an emergency should arise, necessitating the removal of the car from the track. An accident occurred recently on a southern railroad where a car was destroyed by a locomotive owing to the confusion existing among the seven men on the car, although there was ample time for them to remove it from the track in the face of the train if they had been properly organized to do so. A similar accident on an eastern railroad resulted in the derailment of a locomotive and the death of three men.

So far as practical one man should be responsible for the car and its condition at all times. In many cases motor-car operators are selected in a haphazard manner and in other instances the responsibility for the operation of the car is divided among different men, sometimes as widely as there are men in the gang. This means divided responsibility and invariably results in unsafe operation as no two men handle the car in the same manner and neither knows what adjustments the other may have made.

The Care of the Car

The modern motor car is a reliable machine. It has been developed through years of study and experiment, and its operation does not call for any special mechanical skill. Any man of average intelligence and ability should be able to operate a car for years without other than minor repairs.

The life of the average motor car ranges from one to ten years. When we stop to consider that the average section car is in actual use for only one or two hours per day for about twenty days out of every thirty it is apparent that the car should give unfailing service for at least ten years with ordinary care. The fact that the actual life of cars averages much lower than this can be attributed either to faulty operation or to abuse. Records on various railroads show that many cars give long years of uninterrupted service. This is not a matter of chance but is due entirely to careful, intelligent operation.

As an example of the difference between good and bad motor car operation, attention may be called to two cars which came into the motor car shop on a southern line recently for general repairs. One of these cars had been in service for 13 years with only minor repairs while the other car was back in the shop after only 3 months' service.

I think you will agree with me that there is probably no place in railroad work where loss and damage to property are more lightly considered than in motor car operation. Damage to tools and other equipment is usually watched very closely, and careless practice which may result in an expense as small as $5 or $10 generally calls for criticism, but the careless handling of a motor car, that may cause an unnecessary expense of $100 to $150 for repairs, is commonly taken as a matter of fact and accepted without question.

It is impossible to cover every detail of motor car operation but a few suggestions may not be out of order. In the first place, as already stated, one man should be responsible for the car and its condition at all times. He should be competent to operate the car and make such minor repairs and adjustments as are

*A paper presented before the Big Four Association of Maintenance of Way Foremen at Indianapolis, Ind., on August 24.

A Motor Car, Properly Handled, Saves Time and Energy

necessary in the field. The operator of the car should be thoroughly familiar with the rules and if he is careful and efficient he should be allowed to operate the car in his own way provided, of course, that he does not violate existing rules.

The back-seat driver is just as big a menace on a motor car as he is in an automobile. An efficient operator is often made inefficient by suggestions or instructions from occupants of the car, particularly those in authority over him. It is by no means uncommon to find those in authority instructing a motor car operator to operate the car at an unsafe speed and to take other chances that are not in accord with either the rules or good practice.

Proper lubrication is a detail of motor car operation that is frequently neglected. Detailed instructions are usually given by motor-car manufacturers and should be followed closely. The cost of the oil used in the lubrication of a motor car represents only a small portion of the expense for operation and economical maintenance. The oiling of the various parts of the car should be done regularly as required; a few drops applied at the right time are more effective than a quart after the parts have been damaged through excessive friction and wear.

The Abuse of Cars

A common abuse of motor cars is overloading. The loading of rails, frogs, crossties and other heavy material on a car materially shortens its life, causes excessive maintenance and adds to the possibility of accidents. Heavy materials of this kind should always be handled on push or trailer cars.

Cars are continually being abused by excessive loading. An instance may be cited where a car designed to carry two men, with a maximum load limit of 600 lb., was carrying eight men, or a total weight of more than 1,300 lb. and the only reason why there were not more men on the car was that there was no place for them to hang on. In another instance a telegraph gang hauled a telegraph pole 35 ft. in length, together with five men, on a car of the same class. These are perhaps extreme cases but the overloading of motor cars in a lesser degree is common and should be avoided.

Another bad practice is the cluttering up of cars with special seats, boxes, lockers, etc., which not only add weight to the car but invariably result in an improper distribution of the load. Furthermore, where front seats are applied to cars the value of the safety railing is destroyed.

Care should be used in taking the car off the track at road crossings and elsewhere to avoid damaging the wheels and axles and distorting the frame. Particular care should be used to avoid cramping the wheels in the flangeway of a crossing, as this is the cause of many bent and broken axles. Racing the engine on cars equipped with free-running engines, especially when the engine is cool, has worn out and ruined more engines than have ever been worn out in actual service. The engine should not be left running for any length of time when the car is standing.

Cleanliness

Nothing contributes more toward the efficient and economical operation of a motor car than keeping it clean. It has been repeatedly said that a clean car rarely gives any trouble, as keeping the car clean not only tends to improve its operation, but it also follows that if the operator takes enough interest in the car to keep it clean he will also keep it in good condition otherwise. Cleanliness is also an indirect means of preventing accidents for the reason that any defect in the car can be seen more readily if the car is kept clean.

In connection with the importance of keeping motor cars clean I have in mind an incident which occurred a short time ago. A foreman had repeatedly reported trouble with his car on account of his engine missing. The motor car inspector was instructed to make an examination of the car in an effort to locate the trouble. He arrived at the tool house a few minutes after quitting time in the evening. While the foreman had not yet gone home, he was found to be working on an old automobile near the tool house. The hood was up and the inspector noticed that the engine was perfectly clean, free from oil, grease and dirt. He asked to see the motor car and, while opening the tool house was told the car was causing a lot of trouble from missing. In contrast with the automobile engine, the motor car was dirty and the engine covered with dirt and grease. The timer on the motor car was of the ring type with the contacts on the inner circle and with rollers passing over the contact to make a spark, the rollers and contacts being very dirty and greasy. The inspector found a piece of waste and cleaned them off, without the foreman's knowledge. The car was then put on the track and tried out, whereupon the foreman was unable to

make the engine miss. When the inspector explained to him how lax he had been in keeping his car clean and in proper shape he was inclined to resent it, but has since written a letter stating that he now realized that criticism was deserved. It is human nature for one to take care of his own property, but you should not overlook the fact that motor cars have been furnished to help you with your work and make your working conditions more pleasant, and it is to your interest as well as the company's that they be well maintained.

The Causes of Excessive Repairs

All bolts and nuts should be kept tight. Loose bolts and nuts, especially in the frame of the car, are largely responsible for broken and bent axles and engine frames. An excessive number of dry cells should never be used. Four cells will give just as good a spark as a dozen; more than four will ruin the coil. To avoid ignition trouble the spark coil vibrator should be properly adjusted, good connections maintained on all terminals and spark plugs kept clean. If the car does not sound or act right, the trouble should be investigated at once. The complete wrecking of engines on motor cars is by no means uncommon and is nearly always caused by the connecting rod becoming disconnected by either loose bolts or worn bearings. An accident of this kind can be prevented in almost every case, as the engine will always give trouble by knocking before wrecking itself.

A check of the necessity for repairs to motor cars has shown that a large proportion are made necessary by poor operation and careless handling of the cars, damage to cars necessitating repairs being due to a number of causes, chief among which is the action of operators allowing connecting rods to break, which invariably results in wrecking the engine. This can be overcome to a great extent and a considerable reduction made in the cost of motor car repairs if the operator of the car will examine the engine at regular and frequent intervals and tighten all bolts when necessary, particularly connecting rod bolts as indicated by the engine knocking.

One of the principal causes of excessive repair costs in connection with water cooled engines is failure to keep sufficient water in the hoppers, radiators, and engine jackets, which results in the engine becoming overheated, and scoring and wearing the cylinders, etc.

Accidents and Their Causes

Accidents due to motor car operation are taking a more serious toll of lives than is generally realized. In 1927, 116 employees were killed and 3,925 injured in hand and motor car accidents. If those killed and injured were to march before us in single file they would form a line nearly two miles long.

An analysis of 306 motor car accidents occurring during the three-year period ending December 31, 1927, showed that 202, or 66 per cent were from four causes, namely: (1) cars being struck by train; (2) collisions with automobiles; (3) men falling from the cars; (4) derailments. In nearly every case a motor car accident is caused by the violation of some rule. It is apparent that if we are to accomplish the desired results in preventing motor car accidents strict compliance with the existing rules is necessary.

The largest number of deaths from motor car accidents in 1927 resulted from cars being struck by locomotives, a total of 45 persons having been killed in this manner. If the facts were known we would probably find that the majority of these deaths were unnecessary and the result of taking a chance. A flagrant example of this apparent disregard for life is that of an accident which occurred on a southern road about a year ago. A foreman was operating a car after dark, when he was struck by a locomotive, killing one of the men on the car. The headlight had failed on the locomotive and a lantern had been substituted for it. The foreman saw the light but thought the train was some distance away and took a chance, with fatal results. In every case the operator of a motor car should obtain definite information as to the movements of trains and never take a chance when in doubt.

The increased number of automobiles on the highways has further complicated the safe operation of motor cars, and the number of accidents occurring through collisions between motor cars and automobiles is second only to those caused by trains striking motor cars. A case occurred where, instead of getting the push car out of the tool house a foreman loaded two 90-lb. rails on a motor car in a busy terminal and, in passing over a road crossing, struck an automobile, badly damaging both the motor car and the automobile. Another accident recently occurred where a motor car passing over a road crossing was struck by a truck, resulting in very serious injury to the two men on the motor car, one man having his hip broken and the other man sustaining injuries that will confine him to the hospital for five or six months, while it is extremely doubtful if he will ever walk again. An accident occurred a short time ago on a western railroad where an inspection car collided with a school bus at a road crossing. It is hardly conceivable that an accident of this kind could occur if ordinary precautions were observed. When a car hits as big an object as a bus what chance has a Ford?

Getting On and Off Cars

Among the principal causes of injuries to men on motor cars are those due to getting on and off the car and falling from the car. Under no circumstances should a man be allowed to get off the car while it is in motion and he should be permitted to get on the car only when it is necessary to push the car to start the engine, in which case the car should be boarded from the rear.

The majority of the accidents caused by men falling from the car occur in connection with the operation of trailers or push cars. It is the duty of the foreman or man in charge of the car to see that those occupying it are safely seated, and in no case should they ride with their feet between the motor car and the trailer. An accident resulting from a man falling between the motor car and a trailer car resulted in his death and the injury of several men on the trailer.

Derailments are invariably due either to speed or a defective car. Accidents caused through striking animals or obstructions in the track can be avoided in nearly every case by observing the rules in regard to speed. Derailments arising through defects on the car can be overcome by proper inspection. Careful inspection of the car to insure that it is in safe mechanical condition is essential to safety. This is particularly true of brakes, wheels and axles. The failure of a wheel should always be apparent to the operator before it results in an accident. The failure of a wheel on a motor car caused the death of five men only a year ago. The wheel was worn through use and had been further damaged immediately before the accident by running through a derail. It failed on a trestle 35 ft. high, fatally injuring the five men. A similar accident occurred on a southern road where the flange of the

wheel was worn so thin that it broke off while the car was running, derailing the car, killing one man and injuring several others. These accidents could have been prevented if the wheels had been properly inspected.

The careless loading of tools or other material on hand, push or motor cars invites disaster and has resulted in a large number of deaths and injuries. An accident from this cause not very long ago resulted in one man having his back broken, in addition to three others being seriously injured.

When we come to the final analysis, the efficient and safe operation of motor cars rests very largely with the foreman. It has been said that as the top sergeant is to the army so is the foreman to his railroad, for after all the detailed responsibilities are his. His position demands that he exercise his prerogative as a leader. He is responsible for the safety of himself and the men in his charge and it is his duty to discourage unsafe practices and prevent the violation of rules. No man will deliberately invite accidents but the following of unsafe practices will ultimately lead to disaster.

Should Rail Be Laid With Section Gangs?

By E. L. Banion

Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

ON A NUMBER of railways it is now the practice to lay new rail and surface the track, either before or after the new rail is laid, by increasing the force of the regular section gangs or by assembling several section gangs for the work. This practice may prove satisfactory in some localities where experienced men are plentiful, and where conditions permit the section gangs to leave their regular work for long periods of time, but the average section gang has to do "the chores," such as bedding stock cars, unloading station coal, cleaning station grounds, repairing right-of-way fence, spotting low joints, and numerous other small jobs that may require only one or two hours on some days, but which cannot be allowed to wait.

On single-track main lines or on important branches, it is seldom practicable or economical to take the regular gangs off their sections for any length of time. This is especially true where, following the advent of the motor car, the sections have been lengthened to eight miles or more or where, as is often found on roads in the Middle West, soft spots are numerous. On double-track lines, the use of large gangs renders unnecessary the delays and expense of handling all the traffic on one of the tracks while on single-track lines carrying from 10 to 12 trains daily, the delays to traffic are smaller where large gangs are employed.

In territories where crushed stone ballast is used and where dirt and sand are deposited on the ballast, either by the wind or by falling from cars carrying live stock or loose materials, it is necessary to clean the ballast at least every five years to provide drainage and to prevent "puddled" ties, since any of the so-called non-cementing materials serve as good ballast only so long as they are clean. Owing to the desire to obtain as long a life as possible from the rail, it is not good practice to lay new rail on track that has been spotted or surfaced previously without following the laying with a general renewal of the ties and ballast, the cleaning of the old ballast and the straightening of the ties, all of which work can be performed more cheaply if the track is given a general raise. If it is the practice to give the track a general overhauling every time new rail is laid, say every 10 years, and then to depend on the section gang with a small force of men for the maintenance, the ballast must be kept clean, drainage must be maintained in good condition and the track must be kept in good line and surface, not only to avoid bad riding track but also to prevent battered joints and worn rail ends.

If the new rail is laid without being followed by a general surfacing, it will be necessary for the section gang to program its work so that all parts of the section will receive a general overhauling each four or five years. This can be done by renewing 1½ or 2 miles of track out of face each year, so that after the fourth or fifth year the progam may be started again. If the foreman is unable to keep to this program by reason of other work, it is necessary to increase his gang or place an extra gang on his section.

Another objection to laying new rail after the track has been spotted or surfaced without following with a general raise, is that it is almost impossible to line the track properly, for, regardless of the line of the old rail, it is nearly impossible to lay the new rail without lining the track and this is very difficult when the track is embedded in the old ballast.

Under these conditions, rail laying and surfacing programs can be carried on more satisfactorily and economically by extra gangs whose foremen are picked for their ability to supervise large forces and for their experience in this kind of work. The rail-laying gang should complete each day's work as nearly as practicable, by full spiking, full bolting and applying rail anchors, instead of spending a day or two getting ready to make a big showing on a certain day, and then spending another day in completing the job. Completing each day's work in full will not only tend to eliminate irregular gage, but will keep the expansion more uniform and prevent the rail from running and causing "sun kinks" when the track is raised in hot weather. The surfacing gang should keep only far enough behind the rail gang to avoid delays, since this will prevent surface bending of the new rail, which occurs when it is allowed to carry traffic too long before being surfaced.

Motor cars and roller bearing trailers should be furnished to handle large gangs expeditiously, and where a number of motor cars are operated, a motor car maintainer should be assigned to the job to keep the cars in good running order. A regular section car can handle five or six men satisfactorily, even if its performance is not what it should be, but it will not handle large gangs on trailers unless it is in first class condition.

New rail should be unloaded with a crane or derrick and should not be dropped from cars. The crane can also be utilized to unload fastenings and other materials, placing them near where they are to be used. The unloading of rail and other materials in this manner requires only a limited number of men and may be handled by the regular section gang if done in the winter when the section gang can be spared from its other work.

With proper organization and supervision, the larger rail-laying, surfacing and ballasting programs can be handled more economically and efficiently with extra gangs of from 40 to 55 men, under the supervision of a foreman and two assistant foremen, than by increasing the regular section gang or by assembling several section gangs, while it will allow the section gang to keep up with its work, which otherwise would be neglected.

Consistent Program Improves Track Drainage

Careful Planning by B. R. & P. Provides Constructive Work for Track Forces in Winter and Strengthens Roadbed

By E. F. ROBINSON

Chief Engineer, Buffalo, Rochester & Pittsburgh, Rochester, N. Y.

THE IMPORTANCE and necessity of providing proper drainage for the roadbed has always been appreciated and followed as a standard practice on our road and we have always had what would ordinarily be called a well-drained roadbed. Several years ago, in order to improve this essential feature of roadway maintenance, still further, an intensive program of ditching, to be carried on principally during the winter months, was entered into. The result of this program has been not only a very great improvement in the stability of the track structure, but the regular track forces are kept employed during the winter months very largely on this essential and constructive work instead of spending a considerable part of their time in such work as handling snow and other routine employment usually considered necessary during the winter months but which it has been found can be very largely eliminated by careful supervision and programming.

The program of drainage improvement adopted and which we are now following consists of:

1. A thorough scouring, straightening, sloping, and other necessary improvement of existing roadbed and surface ditches.
2. The construction of additional surface ditches, taking care first of locations where there is the greatest need for drainage improvement or where track conditions indicate some concealed obstruction to drainage.
3. Along with the construction of new ditches, the placing of creosoted flumes to confine the water coming out of cuts or other locations and the placing of creosoted drain boxes under the track where needed.
4. In locations where adequate drainage cannot be provided by open ditches, vitrified sewer pipe laid with open joints and trenches filled with coarse engine cinders are resorted to. This plan has been very effective in draining wet cuts and so-called soft spots in the roadbed and other similar locations.

It is our practice to scour and clean out thoroughly all existing roadbed and important surface ditches twice each year, endeavoring each time to make a further improvement of the existing ditches, and after this has been done, additional surface ditches are made. In this way, we provide for the continual and proper maintenance of drainage facilities already constructed before extending our present system of ditches.

At various locations, water comes to the roadbed out of the faces of cuts, from side hills or over the tops of cuts, following the slope of the cut down to the roadbed and resulting in the erosion of the slope, the washing of loose material into the cut and the saturation of the roadbed, causing soft track. In such locations, in addition to ample surface ditching to keep the water out of the cuts, we provide creosoted wooden flumes to confine the water and to prevent the scouring of the slope and the fouling of the ditches by material washed off the slopes, when the water cannot be kept out of cuts by surface ditching. For similar reasons, we frequently find it advisable to provide creosoted wooden flumes to carry the water from the outlets of pipes and other culverts to prevent serious erosion of the slopes of embankments.

Water Pockets Are Drained

In many places on all railroads, there are so-called "sink holes" or "soft spots" which require repeated attention of the track forces for surfacing and lining on account of the track settling and working out of line. Some track foremen regard such places as necessary evils and are content to spend hour after hour and day after day in ineffectually resurfacing the track without making any effort to improve the underlying condition responsible for the trouble. In all such cases, the cause can be traced to water impounded in the roadbed, due to a clay pocket in the roadbed directly under the track, to rock strata in the roadbed, surface water originating at a considerable distance from the track and finding its way into the roadbed, or to other similar causes. The correction of such conditions is made a definite part of our drainage program and the remedy may be found in one or more different expedients, such as digging out the clay pockets underneath or near the track and backfilling with coarse cinders or other similar material, placing drain tile on one or both sides of the track or between tracks, or constructing suitable surface ditches properly located to cut off the water before it reaches the roadbed.

Drainage at highway and farm crossings is a matter which is given very careful consideration. Each location has been found to present a study in itself, requiring special treatment to get the best results. The important point to be considered in this connection is the diversion of the water which comes to the track along the highway into properly constructed ditches, preferably carrying it into surface ditches before it has a chance to reach the roadbed ditches. This can sometimes be done by simply crowning the road and leading the water from the road ditches, which should be paved with field stone if available, into the surface ditches on the right of way. Where possible, the road is sloped away from the track so as to form a low spot in the road, from which the water can be diverted into right-of-way ditches. In other cases, it is necessary to carry the water from the road ditches directly across the track in drain boxes or culvert pipe.

Even though the matter of drainage had been kept prominently in the minds of our division and supervising officers, it was necessary to start a vigorous campaign of education in order to put this extensive program across. This education began with the division

BUFFALO, ROCHESTER AND PITTSBURGH RAILWAY COMPANY

ENGINEERING DEPARTMENT

BULLETIN No. 4

DRAINAGE

To Division Engineers, Roadmasters, General Foremen, Track Foremen, and others interested:—

Thorough drainage is one of the most important principles of track maintenance. If it were not for the effects of water, our track maintenance problems would be comparatively simple.

It is a well known fact that the presence of large amounts of moisture in the soil tends to break down the structure of that soil, and to make it pliable under pressure. Thus, water accumulating in a railway roadbed is inclined to make it soft and easily deformed under traffic. This diminishes the bearing power of the soil under the tie or ballast, and tends to confine the load to a narrower section of roadbed than if the ground were firm.

Do not allow water to stand in or near the track. Remove it by ditching and tiling. Keep running water as far away from the track as possible.

Good, deep ballast will aid in distributing the load over a greater area, but sooner or later much of this material will be driven into the ground, and thereby lose its effectiveness for maintaining drainage and proper support for the ties.

It is useless to apply new ballast and not keep the water away from it, and it is useless to attempt to tamp ties in ballast saturated with water.

Water in, under or near the roadbed will destroy the power of the ballast to distribute the load, thus causing the track to "churn" and suck the sub-grade up into the ballast, resulting in muddy ballast, low and whipping joints, loose bolts, cut ties, spread track, bad surface and life.

Keep roadbed ditches clean, free from vegetation and obstructions at all times so the water will run freely.

Keep the water out of cuts wherever it is possible to do so by constructing ample surface ditches, properly graded, sloped and lined, and leading to water courses. **Give the water a chance to run off.**

Place crocoated flumes for conveying the water down the slopes to and from the inlets and outlets of pipes and culverts, to avoid cutting or scouring of the slopes, and filling up of roadbed ditches.

Construct surface ditches at the foot of embankments and parallel with the track where the nature of the ground will permit, to prevent standing water. Do not allow borrow pits or holes on the right of way to stand full of water; drain them.

Lay drain tile in wet cuts as called for on standard plans. Keep the mud cleaned off the top of the cinder covering of the tile so that the water will have free access to the tile. Keep the water moving.

Lay drain tile between tracks where there are evidences of water in the roadbed.

After tile has been placed, do not say that job is done. Watch the tile, see that the water is running through it and when necessary take it up and clean it.

Heaving track in the winter is caused by freezing water in the ballast or roadbed. The use of shims is prohibited. Shims are a poor excuse for correcting the effects of poor drainage. Get the water away from the track, and remove the cause of heaving. **Ditch and lay drain tile.**

The difficulties arising from lack of drainage are increased in colder regions by the action of frost. The uneven distribution of water in the soil causes some places to heave more than others while frozen, producing an unevenness in the surface of the track. This heaving leaves the ground open and porous when the frost leaves in the spring, and tends to exaggerate the unstable conditions of the roadbed.

Center-binding of track is increased by high percentages of moisture in the subgrade. This has a tendency to produce a rough-riding track, and if the conditions are extreme, may result in the breaking of rails.

In many cases the drainage of the subgrade will prolong the life of the ties against decay and rail cutting. Decay, as we all know, is caused by a fungus growth that dissolves certain elements in the structure of the wood, and which among other things requires a certain percent of moisture for its propagation and development. In the case of ties, it is most active when the air is warm, and when there is the greatest amount of moisture in the wood. A tie that contains a high percentage of moisture cannot resist mechanical wear as well as one that is dry. **Keep the roadbed dry. Keep the water moving.**

Crocoated drain boxes should be placed at road crossings, switches, in cuts and all other places where water is liable to accumulate. Drain boxes should be placed at frequent intervals on double track, especially on grades, for conveying the water from between tracks. Do not allow the water to run long distances in cuts or between tracks. Get it away from the track quickly by ditching, putting in drain boxes, and cast iron pipe. Do not place drain boxes with the inlet end so high that water cannot freely enter.

Drainage at highway and farm crossings must be given special attention. Ditch, lay drain tile, and place drain boxes and pipe to keep water away from the track and from under the track at crossings.

Construct ditches of proper size and slope at sides of crossings and pave them with field stone, to prevent scouring and washing of dirt into the roadbed ditches, drain boxes and pipes, and on the crossing. Construct diversion ditches if possible some distance from the track, especially where the road slopes toward the track to catch the water and prevent it from running down over the crossing.

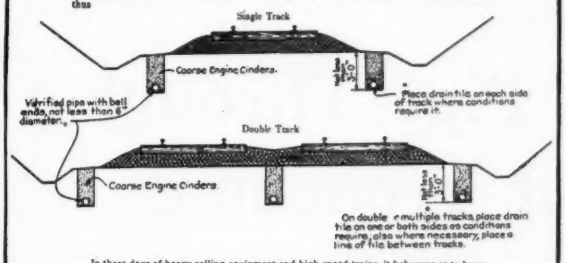
Use every means at hand to keep water away from the track at crossings.

Each crossing is a study in itself and requires special treatment.

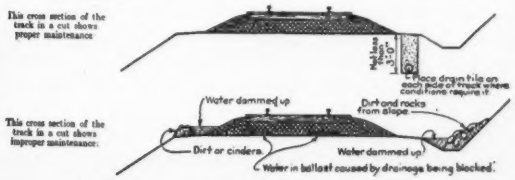
Our standard plan calls for placing drain tile not less than 3 feet below subgrade. It is necessary to lay drain tile deep enough to prevent the water from being "sucked" up to and through the ballast by the movement of traffic. Even where the ballast is supported on a rock subgrade in cuts it is necessary to place the drain tile a sufficient depth in the rock to remove all water from water pockets, or from fissures in the rock. Generally, it is necessary to place the drain tile in rock cuts as deep as in other places.

Drain tile must have proper fall to keep the water running freely, and where the track is not laid on a grade which can be followed for the slope of the tile, engineer's stakes should be set.

Lay drain tile and backfill with coarse engine cinders in accordance with standards, thus



In these days of heavy rolling equipment and high-speed trains, it behooves us to have our track in the best possible condition at all times to provide for economy in operation. In many cases the subsoil drainage problems have increased with the introduction of heavier motive power. The soil is compressed under these heavy loads, forming depressions under the track that tend to hold water on account of the depression itself, and also on account of the increased compactness of the soil. The difficulties that arise on account of these pockets can be eliminated only by proper methods of subsoil drainage. **Ditch and lay drain tile.**



So-called sink holes under or near the track are nothing more than water pockets caused by springs, depressions or fissures in the subgrade, or by deposits of clay in fills made during the construction period. Drain these places with tile, or dig down on the outside of fills and provide openings for the water to run out and then backfill with coarse material, such as stone and cinders. **Keep the water moving.**

Standing water in, under or near the track is our worst enemy, remove it. Keep drainage uppermost in your mind throughout the year in all your work and do not allow the drainage to become clogged.

Ditch and drain and then ditch and drain some more. Keep the water moving.

Drainage will pay for itself many times over in prolonging the useful life of ties, in keeping the ballast out of the mud, in reducing damage to rails, and track fastenings, in reducing labor for surfacing and lining, and in reducing the number of derailments, and increasing the load and the speed of the moving train.

In the winter, open and clean ditches, dig new ditches, open waterways, place drain tile, crocoated drain boxes and flumes. **Keep the water running.**

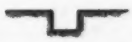
In the spring, open and clean ditches, dig new ditches, open the inlet and outlet of all culverts, pipes and drain boxes, place drain tile, crocoated drain boxes and flumes. Keep the water running so that the track will dry out as soon as possible.

In the summer, during the progress of the season's work, such as rail renewals, tie renewals, surfacing and ballasting, keep the matter of drainage constantly in mind. Keep the track filled in and dressed off. Strip out crossings, get rid of muddy ballast as far as possible to do so. Place drain boxes at all points where water is liable to accumulate, especially at highway and farm crossings, switches, crossovers, etc., lay tile and place crocoated flumes and drain boxes.

In the fall, put all ditches and drainage in good shape and get water away so that the track will go into the winter with the roadbed as dry as possible, thus avoiding heaving. Do not allow water to stand in or near the track.

Make good, ample ditches and slope them, thus:—

Do not make narrow ditches with straight sides, thus:—



Do not make crooked ditches, thus:—

Make them straight, thus:—

Keep the ditches clean. Keep the water out of cuts. Keep the water moving. Lay drain tile. Place drain boxes and flumes. Keep the matter of drainage before you at all times.

E. W. HAMMOND,
Engineer Maintenance of Way.

Approved:
E. F. ROBINSON,
Chief Engineer.

Rochester, N. Y.,
December 15, 1927.

A Bulletin Outlines Drainage Practices

officers and extended through them to the supervising officers and to the foremen. In many cases foremen were not quick to realize the immediate and continuing advantage of drainage improvement and it was necessary to demonstrate these facts to them by the simple expedient of requiring them to make surface ditches in locations where roadbed conditions were troublesome on account of poor drainage and letting them see the actual results on their own sections. It has been demonstrated to our foremen again and again that the time of their men is far better spent in digging a well-designed and proportioned ditch or system of ditches for draining the water from the roadbed than to spend several hours

a week or several days a month in continually raising soft spots in track, resulting from poor drainage conditions.

In order to stimulate a spirit of rivalry among the various officers and foremen, a weekly record in the form of a chart is prepared and issued to the roadmasters, showing the progress of cleaning existing ditches and making new ditches on each section, with totals shown for each roadmaster's division; all plotted on a convenient scale so as to make a comparative exhibit of progress. Statements are also sent out frequently showing the number of hours spent by each section gang on the work of ditching and laying drain tile, in comparison with the amount of time spent in handling snow.

We have found the constant reiteration of simply worded instructions, slogans and catch phrases a very effective means of arousing the interest of the foremen in this important work, and it is our thought to keep constantly before them the essential principles of good drainage. Circulars and letters of instructions in easily understood language, with frequent repetition of outstanding facts and requirements, are issued to the supervising officers and foremen from time to time, and the matter of drainage is made a constant subject of verbal instructions and conversation with officers and foremen. In fact, it is our usual practice to begin any talk with our men with the subject of drainage and to refer to it again at the close of the conversation. As a further reminder of the vital necessity of good drainage, placards in large black letters on white background have been posted on bulletin boards in all toolhouses and all other places where employees congregate, reading, "ALWAYS KEEP DRAINAGE IN MIND."

At the beginning of the winter season a definite line-up of ditching to be done on each section is laid out by the roadmaster after consultation with the division engineers, and in locations where conditions are particularly difficult, the situation is studied on the ground by the division engineer and roadmaster, if necessary, a survey is made to determine the best method of improving existing conditions.

An indication of our actual accomplishment in drainage improvement is contained in the following figures:

Winter of 1924-25:
- Number of miles of existing surface ditches scoured, cleaned, sloped and otherwise improved..... 82
- Number of miles of new surface ditches dug..... 19

Winter of 1925-1926:
- Number of miles of existing surface ditches scoured, cleaned, sloped and otherwise improved..... 88
- Number of miles of new surface ditches dug..... 17

Winter of 1926-1927:
- Number of miles of existing surface ditches scoured, cleaned, sloped and otherwise improved..... 93
- Number of miles of new surface ditches dug..... 18

During the past few years we have laid about 15 miles of 6-in. and 8-in. drain tile per year, mostly in wet cuts. While generally one line of drain tile through a cut is sufficient, in some cases we have found it necessary to lay two lines, one on each side of the track, and in double-track territory it has also been found necessary, in some cases, to lay three lines of drain tile through a cut, one on each side of the track and one between tracks. Up to the end of last year we had laid a total of approximately 100 miles of drain tile, mostly 6-in. and 8-in. vitrified tile with bell ends.

Installing a Drain Pipe Through a Levee Without Trenching

THE installation of a storm sewer outlet through a levee without trenching was a problem that recently confronted the Levee Improvement Commission of Davenport, Iowa. The levee was used as a railroad embankment as well as a protection against backwater from the Mississippi river and for these reasons it was undesirable to trench through it, even for a short time.

Originally constructed across a swamp with no facilities for cross-drainage, the embankment formed a dam which impounded water from several storm sewers. The resulting stagnant water, together with the fact that an adjoining area was used as a city dump, brought about a very unsanitary condition which the Levee Improvement Commission determined to eliminate in order to improve the land for industrial uses.

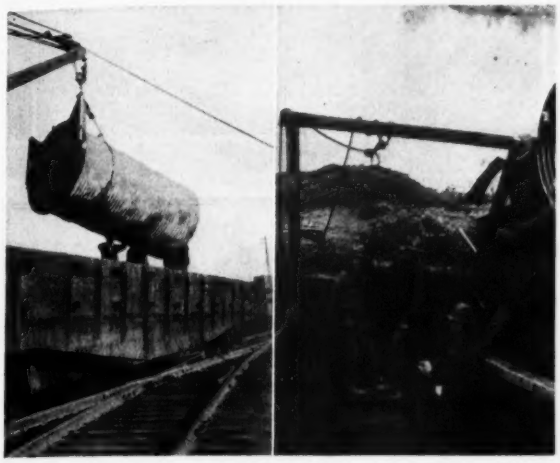
For this purpose about 50 ft. of 60-in. Armco paved invert corrugated iron pipe was procured, and the Armco jacking method was adopted as the most satisfactory method of installation. To prevent backflow from the river during flood periods the outlet end of the pipe was provided with a Calco automatic drainage gate, and as a protection against future corrosive industrial wastes, the pipe was bituminous-coated inside and outside.

The embankment at the site of the proposed installation was 18 ft. high, 26 ft. wide at the top, and about 90 ft. wide at the bottom. The elevation of the normal water level at the proposed outlet end of the pipe was 12.5 ft. and at the inlet end from 3 to 5 ft. higher. The main track of the Davenport, Rock Island & Northwestern was located on the embankment, and that company supervised the placing of the pipe.

Actual installation work began with the excavation of an approach trench or pit about 15 ft. long on the outlet side of the embankment, extending to a point about five feet from the water's edge and down to the proposed flow line of the pipe. Finding the embankment somewhat unstable, a buttress of old bridge ties was constructed across the upper end of the approach trench and anchored by means of a cable to a deadman in the opposite side of the embankment. Old bridge ties were also embedded one above another at the opposite end of the trench as a backstop for the jack.

Meanwhile short mud sills had been embedded in the bottom of the trench, and on these, running lengthwise of the trench and at right angles to the mudsills, were placed the two lining timbers, spaced 30 in. apart and laid to exact line and grade to hold

the sections of pipe in place and to guide them accurately into the embankment. When all these preparations were completed, the first 10-ft. section of pipe was rolled onto the lining timbers and the jacking was ready to proceed. A 14-in. timber was used for a bearing block against the end of the pipe to transmit the pressure of the jack to the pipe. It proved very satisfactory and did not damage the pipe



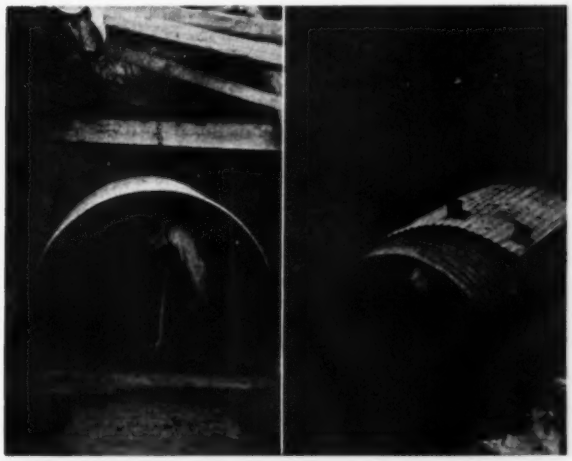
Left: The End Section of Pipe with Flood Gate. Right: Equipment for Jacking Pipe into Place

under the extreme pressure exerted by a 75-ton ball bearing screw jack.

With the first section of pipe jacked up against the face of the approach trench, a man inside the pipe started the excavation with a short handled adze, the excavated material being removed by casting it from one man to another. Several inches of dirt was placed in the bottom of the pipe to protect the coating during installation and, to provide a smooth surface for shoveling, a piece of light gage sheet metal was used wherever casting was done.

After the second section had been riveted on, it was observed that great pressure was needed to keep the pipe moving, undoubtedly due to a rain that had thoroughly saturated the fill. When 30 ft. had been jacked into place this condition delayed progress to such an extent that it was decided to suspend work from the downstream side and to jack the remaining 20 ft. from the other side of the embankment. An approach trench was then prepared on the opposite side, provided as before with lining timbers and a backstop. A metal shield was placed over the top of the pipe to reduce friction and with this provision the rate of progress was increased from 1.3 ft. per hour to about 2 ft. an hour. The alinement was maintained so well that when the sections finally met underground, it was possible to jack the end of one pipe a full corrugation over the other.

In spite of the difficulties encountered and the unexpected need for jacking from both sides, the method proved to be much more economical than the trenching method would have been. Compared to an estimated labor cost of $1,400 for the open trench



Left: Excavating with Jacking in Progress. Right: A Metal Shield on the Pipe Reduced Friction

method, the cost of jacking was only $410—a very substantial saving, in addition to the other advantages obtained by that method. The work was carried out under the direction of N. H. Tunnicliff, consulting engineer for the Levee Improvement Commission, and F. S. Wiesbrook, general manager of the D. R. I. & N. W.

Picacho Peak on the Southern Pacific in Arizona

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE NOVEMBER ISSUE

1. *To what extent are the bottoms of ties, particularly those of soft woods, damaged by tamping? What practical means can be used to prevent this damage?*

2. *What is the most economical method of replacing an individual pile in a bent of a ballast deck trestle?*

3. *Are there any advantages in, or objections to, the use of oil on slide plates of switches and spring rail frogs? What type of oil is best for this purpose?*

4. *What is the best finish for wooden floors in passenger stations, from the standpoints of protection to the floor, maintenance of the finish and appearance?*

5. *What measures should be taken at the approach of winter to prepare for the operation of flangers and snow plows?*

6. *What is the best method of preventing the clogging of intakes of suction lines with ice?*

7. *What measures should be taken to insure the proper functioning of switch lamps at all times?*

8. *When explosives are used to break up heavy ice adjacent to bridges, how should the work be done to obtain the best results?*

Gage Rods for Sharp Curves

Under what circumstances is it advisable to install gage rods on sharp curves? What advantages result from their use?

Their Use Will Often Lengthen Life of Ties

By E. D. Swift

Engineer Maintenance of Way, Belt Railway of Chicago

Gage rods, which were used extensively before tie plates were generally adopted, are again being employed on sharp curves in yards and terminals where the tracks have a tendency to spread. Our use of these rods varies with circumstances. In certain cases, where sharp curves are unavoidable and a track will be subjected to heavy traffic, they are installed at the time the track is built; in other cases they are put on only when the ties become a little soft so that they will not hold the track to gage with the aid of the tie plates and spikes alone. Used in this latter way, they enable us to secure longer life from our ties with safety and at small expense, since we use adjustable rods which can be applied quickly.

Gage rods used immediately ahead of the switch points are not only cheaper but are more satisfactory for holding the track to gage at that point than are gage plates. When gage plates are used, there are several points of wear; these being the flanges of the rails, the rail braces on the plates and the upturned ends of the plates themselves, all of this resulting in widened gage. When adjustable braces are used, the gage can be brought to normal by their use, but it can be done more quickly and cheaply by an adjustable gage rod immediately ahead of the points.

When gage rods are used they should be of such design that they can be applied or taken off without pulling the spikes, and should be adjustable so that they can be used for different weights of rails or tightened up to compensate for wear. These features eliminate the objections to the old solid gage rods with hooks forged on each end, and cost but little, if any, more. Our rods are 1½ in. in diameter, with a hook on one end to engage the flange of one rail and a clip and a follower nut to engage the flange of the other rail. This type of rod contains much less metal than was necessary for the solid rods formerly in use and has the further advantage that, in track circuit territory, it can be insulated at small cost.

Should Be Used on Sharp Curves in Yards

By L. J. Drumeller

Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

On sharp curves in terminals or yards, where heavy power is used, it is advisable to install gage rods on curves of 10 deg. or more, and ahead of switches on sharp curves. However, on private side tracks or light traffic yard tracks, where the axle loads are light and the wheel base of the engines is short, it is not advisable to install gage rods.

The advantages derived from the use of the gage rod may be summarized as follows: (1) They prevent wide gage; (2) Where no tie plates are used, and in some locations where plates are used, they prevent mechanical wear on the cross-ties; (3) Excessive gaging will be eliminated or cut to a minimum by the use of gage rods. Care should be exercised to see that the gage rods are well insulated in main line automatic territory.

Control of Water Level in Interconnected Tanks

Where several tanks widely separated are supplied with water from the same pump, and it is impracticable to place the tops of the tanks at the same elevation, what is the best method of controlling the level of the water in the different tanks?

Some Cases Require Considerable Study

By C. R. Knowles
Superintendent Water Service, Illinois Central, Chicago

The simplest method of controlling the level of water in several tanks at different elevations and supplied from the same source is by means of float valves, the tank at the highest elevation being used as a control tank, that is, the water level in the higher tank governing the operation of the pumps.

The principal objection to this arrangement is that the available storage capacity of the higher tanks is greatly reduced, as the water will flow to the lower. Assuming that the demand on all tanks is approximately the same, the capacity of the higher tanks will have to be greatly increased to provide for all requirements.

Another objection is that all water will have to be pumped against the head equal to that of the higher tank. These objections may be overcome by placing check valves in the discharge lines to the higher tanks to prevent the water from flowing back to the lower tanks. This also has the further objection that when the pumps are started, the tanks at the lower level will fill before water is delivered to the tanks at a higher level, with the result that the water supply may be exhausted before the tanks are filled, depending upon the relative consumption of water from the various tanks and the intervals between pumping.

To overcome these objectionable features it is necessary either to operate the pumps at more frequent intervals, or to install electrically-operated valves in the discharge lines to the various tanks, these valves to be under the control of the pump operator to enable him to discharge water into any of the tanks by operating the necessary valves, controlled by switches located in the pump house. Altitude valves may be substituted for the float valves where there is liable to be interference with the operation of floats from ice or other causes.

The level of the water in the various tanks should be indicated to the pump operator by means of an electric alarm system, connected either to the control tank or to all tanks, as desired. This control system may be a single bell made to operate either from a single float switch in the control tank, or by a switch located in each of the other tanks. A single circuit will, of course, indicate to the pumper that the water level has dropped in one of the tanks. However, a multiple system of switches and wires can be installed that will indicate the level of the water in each particular tank, either by a series of bells of different tones, or by different colored lights.

A typical example of maintaining water levels in tanks of varying heights and remote control is found in the Markham Yard of the Illinois Central at Chicago. This yard is supplied by five 100,000-gal. water tanks and one 50,000-gal. tank. The distance of the tanks from the pumping station ranges from 1.9 miles to 4.5 miles. The contour of the ground is such that it was impossible to locate these tanks at the same elevation. Therefore, they are located in three groups, each group of tanks being at a different elevation.

Group 1 consists of two 100,000-gal tanks, with the top of tank at Elevation 80; Group 2 consists of three 100,000-gal. tanks, with the top of tank at Elevation 89; the third consists of the 50,000-gal. tank, whose top of tank is at Elevation 106.

Each tank is equipped with a float valve. Check valves are located between each group to prevent water from flowing from a higher tank to a lower tank. A float switch is located in one tank of each group which is set to start the pumps when the water level is lowered 24 in. The pumps continue to operate until all tanks are filled, when they are stopped automatically. The pump control switch is set to operate a few inches ahead of the float valve in order to guard against overflow in the event that the float switch should fail to operate.

The details of this arrangement were perfected only after considerable experimental work. While the design was provided for automatic control, it was found that considerable time and patience were required to obtain unison of operation between the float valves and float switches so that they balanced properly. However, these details were successfully carried out and the control, both as to water levels and the operation of pumps, is working out very nicely, although the nearest tank is nearly two miles from the pumping station.

Float Valves or Pressure-Regulating Valves Will Usually Suffice

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

The usual, and ordinarily the cheapest, method to take care of a situation of this kind, is to provide automatic self-closing valves which will operate by means of a float on the surface of the water in the tank and gradually cut off the supply from the pump as the tank becomes full. These devices should be placed in those tanks, which, by reason of location or elevation, will naturally be filled first, having the last tank as the one from which, by gage pressure or direct observation, the pump operator will be advised as to when to stop pumping. In other words, the tank which fills last should be permitted to float on the system without any positive acting shut-off valve, as otherwise the closing of the last valve might cause serious damage to pipe lines, valves, or pumping equipment. If a centrifugal type of pump is in use, the closing of the last valve will probably cause no damage, but as the water churns in the pump the operator might not notice the trouble and leave the pump in operation with consequent waste of power.

In very cold sections of the country, trouble is

frequently experienced with valves such as described above on account of the formation of a layer of ice across the top of the tank of sufficient strength to support the float and thereby hold the valve closed after the water has been lowered in the tank. If it is impracticable to prevent the formation of ice by artificial heat from a stove located in the riser pipe housing or by other means, and the use of the water is so intermittent as to permit the formation of the ice layer, then a good method is to place a reliable pressure-regulating valve in a suitable frost-proof housing at some convenient point on the line, so that the flow will be cut off automatically when the pressure head becomes equal to that from a full tank.

Lengths of Panels for Wire Fences

What are the most desirable lengths of panel for barbed wire and for woven wire fences? What reasons lead to these conclusions?

Panel Lengths of 24 Ft. Are Satisfactory

By Division Engineer

The most satisfactory length of panel for a wire fence of either barbed or woven wire is the longest which can be used and still hold the fence tight, since a large part of the cost of a fence is the cost of the posts and the labor required to set them. When wire fences first came into use, a panel length of 16 ft. was used almost universally, partly because the original board fences were built in panel lengths of 8 ft., and partly because stays were not used on ordinary barbed wire fences and a greater panel length permitted the wires between the posts to be moved vertically with little effort.

With the use of intermediate stays, it was found that the panel lengths could be increased and it is now not uncommon to place the posts from 20 to 32 ft. apart, depending on the use of the property along which the fence is located. Along cultivated land, I have used 32-ft. panels successfully, but where the land is utilized as pasture, or where stock is turned into the fields after the crops are gathered, the 24-ft. panel should be used. Since the character of use of the land may change from time to time it is best to adopt a panel length which will serve for all purposes and my experience has been that a length of 24 ft. is satisfactory for a general purpose fence of either barbed or woven wire. Before adopting any particular length of panel it is well to look into the laws of the state in which the fence is to be built, since this matter is often regulated by legislation.

Use 32 Ft. for Barbed Wire and 16 Ft. for Woven Wire

By C. W. Breed

Engineer of Standards, Chicago, Burlington & Quincy, Chicago

We use 16-ft. panels for our standard woven wire fences and 32 ft. for the standard barbed wire fences, except in states where panels shorter than 32 ft. are required by the state laws, which vary from 16 ft. to 40 ft. We have used these panel lengths for a number of years and they have been satisfactory.

Woven wire fence is installed where it is necessary to fence against all kinds of stock, including sheep and hogs, and consists of a 26-in. width of woven wire at the bottom, with three strands of barbed wire above, the height from the ground to the top wire being 54 in. Two intermediate stays, 44 in. long, are spaced at equal distances between the posts, extending from near the bottom of the woven wire to the top barbed wire.

Two standard barbed wire fences are used, one where it is necessary to fence against sheep but not against hogs, and the other where it is unnecessary to fence against either sheep or hogs. The first of these fences consists of 5 barbed wires, the lowest wire being 8 in. above the ground, and the top wire 54 in. above the ground. In this fence intermediate stays are spaced 4 ft. 7 in. apart, thus providing 6 stays to the panel where the posts are 32 ft. apart. The other type of barbed wire fence, which is used where only cattle and horses are to be turned, has four barbed wires, with the lowest wire 13½ in. above the ground and the top wire 54 in. above the ground. In this fence, the intermediate stays are spaced 5 ft. 4 in. apart, giving 5 stays to the 32-ft. panel.

These lengths of panels were adopted to furnish efficient fences at a minimum of cost, the 32-ft. lengths making a material saving over the shorter panels, on account of the fewer posts and labor required for their installation.

Grass Fires on Right-of-Way

What can the track foreman do to protect adjacent fields from grass fires originating on the right-of-way?

Care Must Be Taken in Various Ways

By Roadmaster

Grass fires originating on the right-of-way and spreading to adjacent fields are usually occasioned by allowing the grass and weeds to become so dry that they are set on fire by sparks from passing locomotives or from burning ties where it is the practice to dispose of the old ties in this manner. The way to prevent such fires is to dispose of the grass and weeds before they become dry enough to catch fire easily from sparks.

When the grass and weeds begin to get dry they should be mowed and burned as soon as possible after mowing, and when this is being done enough men should be assigned to the work so that any fires which may start in adjacent fields may be put out promptly. In mowing the right-of-way, all grass and weeds growing along and under the right-of-way fence should be cut; it is often advisable also to mow a swath along the fence line on the field side. This will not only serve to prevent the spread of a fire from the right-of-way but will also improve the looks of the roadway as well as lengthen the life of the fence.

Friendly co-operation with the land owner will often induce the latter to plow fire guards on his land near the right-of-way fence, and while this is for his own protection he is more apt to do it if he sees the foreman is in earnest in attempting to do his share.

Fires often spread to adjoining fields from piles of burning ties. For this reason, the ties should be burned only at times when there is no wind or on damp or rainy days. The practice of piling up the ties at the end of each day's work and setting fire to them just as the gang is going home should never be permitted. They should be burned during the

day time so that they may be entirely burned out by the time the gang starts home, at which time any embers should be spread out and covered with dirt to prevent their being blown about by the wind.

Mowing and Burning Strips Cheaper Than Plowing

By Fred Lange

Section Foreman, Northern Pacific, Moorhead, Minn.

For a number of years, at places where fire guards are needed, I have had a mower cut two swaths in the summer before the grass begins to dry up. After mowing, this grass is allowed to dry for a few days and is then burned as it lies. New grass will come up on this burnt-over strip and it will stay green until freezing weather, making a very effective fire-break at only a fraction of the expense of plowing.

Stucco for Old Station Buildings

Under what conditions is it economical to apply stucco to old station buildings?

It is Economical When the Buldings are Sound

By A. C. Irwin

Manager, Railways Bureau, Portlant Cement Association, Chicago

It is understood that the question refers only to buildings that are sound structurally or can be made so at little expense. The external condition and appearance are the deciding factors in such cases. The answer to this question is usually obvious and in favor of overcoating, but not always so. There are local conditions of labor supply and material that may favor one or the other strongly but, in general, it is more economical to leave the exterior undisturbed and apply stucco. The exterior will then not require painting, although, for the sake of appearance, the stucco should be washed at intervals or given a coat of stucco paint.

The process of over-coating with portland cement stucco is neither difficult nor expensive. All trim, door frames and window frames are extended an inch or more, so that they will be in proper position when the stucco is in place. After the old siding has been nailed down to afford a firm base, building paper is placed over the entire surface to be stuccoed. Over this, by means of furring nails, expanded metal is secured, the special nails holding it about three-eighths of an inch away from the papered wall, or at the approximate center of the stucco slab. The stucco itself is applied in three coats, a scratch coat which is forced well between the meshes of the metal, a brown coat and a finish coat. Each coat is given two days of moist curing and sufficient additional time to dry before the next coat is put on.

One part of portland cement to three of clean sand is the usual proportion used, with hydrated lime as an optional admixture up to 10 per cent, by weight, of the cement. Materials in that proportion are used for each coat, thoroughly mixed; the addition of mineral pigment to the finish coat, if color is desired, does not materially affect the proportioning.

Properly executed, a stucco over-coat for a frame station adds considerably to its usefulness. The addition of building paper and stucco to the walls serves as a protection from the weather, hot and cold. The chances for damage by fire are minimized and the need for periodic re-decoration is eliminated.

The most immediate and obvious of the benefits gained by stuccoing old stations is the improved appearance. The building need not be made to look like the Spanish Renaissance bungalows effected by some realtors; in many instances its archiectural lines are retained, unchanged. But the advantage of neat, clean-looking, modernized stations is great; they become, in effect, permanent advertisements reflecting the policy of the line.

Materials required per 100 sq. ft. of surface include, aside from building paper, expanded metal or metal lath, furring nails, etc., 2.94 sacks of portland cement, 8.80 cu. ft. of sand and a maximum of 29 lb. of hydrated lime. This estimate is based on a stucco slab ⅞ in. thick.

Uses of Stucco Reduces Maintenance Costs

By Assistant Engineer Maintenance of Way

When the siding of an old station building has deteriorated to such a point that new siding is required, it will usually be found economical to apply stucco over the old siding instead. In most cases the cost of applying the stucco will be about the same as that of removing the old siding and replacing it with new. This being the case, the relative economies will be determined on the basis of a comparison of maintenance costs of the two types of construction.

It is necessary to paint frame stations every few years, and this item of expense is almost entirely eliminated where stucco is used, the only exterior painting necessary on such buildings being the doors, the window and door frames and such small amounts of wood trim as may be used with the stucco. The extent of this saving will depend, of course, on the intervals between paintings, which is governed largely by the attention which is paid to appearances. If the building is painted often, the application of stucco will result in larger savings than if it is the practice to paint only at long intervals. On the other hand, when the latter policy is followed, the stuccoed building will present a better appearance most of the time than the building with wooden siding.

Precautions in Widening Banks

In widening banks by work train, what special precautions should be taken to prevent the new earth from slipping off the slopes of the embankment?

No General Method Can Be Used

By George R. Smiley

Chief Engineer Construction, Louisville & Nashville, Louisville, Ky.

It is almost impossible to answer this question in a general manner, as so many conditions may affect the work. As an example, it is frequently unnecessary to take any special precautions where the bank widening is done with heavy rock as has been the case with most of our work of this character during the last few years.

On Muldraugh's Hill and on our Kentucky division work, we widened many embankments without taking any special precautions because the material used for filling was large rock, which would not disintegrate and which, when dumped from the cars, broke up the slope as well as could have been done in any other way. On some fills which were covered with cinders, we removed the cinders; on others we built up the fills carefully from the bottom and

bonded them into the old fill. On certain earth fills, we removed all the vegetation and broke up the slope so that the newly placed earth would bond with the old embankment. Each case was handled separately and on its own merits.

On most of our second-track construction, we try to locate our new second track so that one of the tracks will be entirely in either cut or fill. In a great many cases this adds to the first cost of the work but it does make the maintenance problem considerably easier.

Usually Necessary on Clay Embankments

By Roadmaster

In many cases it is unnecessary to take any special precautions to guard against the sliding or sloughing of new dirt plowed off of work trains for widening banks, but where any doubts exist as to whether or not such sliding is apt to take place it pays to be on the safe side, and take such steps as seem necessary to prevent it. The extra expense occasioned by sliding material will usually be considerably more than the preventive measures would cost, leaving aside the unsightly appearance caused by the slides.

Sliding usually occurs when clay is unloaded along embankments composed of clay, or where a heavy growth of grass has sprung up. Usually the easiest and cheapest way is to plow furrows lengthwise in the side of the old bank or, where this cannot be done conveniently, to roughen the bank in a similar way by means of picks and shovels. Where the vegetation is not too thick this will usually be sufficient, but if the growth is heavy it should be mowed and removed. Where the side of the old bank is covered with brush, this should be cut off a few inches above the ground and the cut-off portions removed before the new dirt is unloaded.

Earth unloaded along banks in the winter time when the ground is frozen is very apt to slide off when the frost goes out of the ground and when the work must be done at such times, the bank should be roughened before freezing weather sets in, since the cost of doing this in frozen ground is excessive.

Concrete Slabs for Trestle Bulkheads

What are the relative advantages of timber and concrete slabs as bulkheads for timber trestles, taking into account both original cost and maintenance?

Concrete Slabs Reduce Fire Hazard and Are Economical

By G. A. Haggander

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Several years ago we decided that our practice of using second-hand timber for bulkheads in pile trestle bridges was not economical because they deteriorated quickly when in contact with the ground, and the track at the end of the bridge, which is difficult to maintain, had to be disturbed when renewals were made. We also found that a good many fires started at the point where the timber had become decayed because of being in contact with the ground.

We then started using second-hand creosoted lumber. On account of the number of uses for second-hand bridge lumber, making it difficult to get it in sufficient quantities, we conceived the idea of making the bulkhead planks of concrete. Several test installations were made in 1927 and these were so successful that they were adopted and have been used for all bulkhead work in connection with the 1928 program.

The planks are 4 in. thick by 12 in. high, and vary in length from 8 ft. 8 in. to 12 ft. 4 in. The weight varies from 435 lb. to 620 lb. They are reinforced with three ½-in. rods. From two to six planks in height are used for various heights of bulkheads. They are held together by concrete cleats and bolts.

The cost of these concrete bulkheads has proven to be slightly less than that of second-hand creosoted lumber bulkheads, and the fire risk on timber bridges is greatly reduced. While we have not had very much experience with them we feel that they will be entirely successful.

Depends on Type and Importance of Structure

By J. S. Huntoon

Assistant Bridge Engineer, Michigan Central, Detroit, Mich.

In order to determine the relative advantages of timber and concrete slab bulkheads for wooden trestles, it is necessary to consider the type of trestle and traffic on each particular line.

On unimportant divisions, it is customary, by reasons of economy, to build pile trestles of untreated timber with open floors and maintain them by renewing the different members as they wear out. The bulkhead is usually constructed of once-used timber. It is common practice to use old stringers for this purpose, which last from seven to nine years. A bulkhead for one end of a bridge, constructed of once-used timber and approximately six feet high, will cost from $125 to $175, depending on the value placed on the old timber and the field difficulties experienced in making such a change. Where trestles are constructed in this manner, it would not be consistent or economical to build bulkheads of better material than is used in the remainder of the structure.

If the traffic demands a better type of trestle, it is constructed of concrete piles and slabs, creosoted ballast floor or creosoted pile bents and steel stringers. With such construction it is advantageous to use bulkheads of concrete slabs or creosoted timber. A bulkhead of creosoted timber for one end of a bridge about six feet high, will cost about $225 at present prices. A concrete slab bulkhead 12 ft. high cost $325 in 1915 and one 10 ft. high cost $370 in 1916. Concrete slab bulkheads 6 ft. high cost approximately $230 each in place. Trestles should be designed so that the bulkheads will not be over 6 ft. high, as bulkheads over that height are expensive to build and maintain, while they also require special construction to resist bank pressure and surcharge from live loads.

Concrete trestles are constructed so that the cap and back wall take the place of a bulkhead. It is desirable to use either creosoted timber or concrete slab bulkheads for creosoted ballast floor or other semi-permanent bridges. If concrete slabs are used, the design should be standardized and they should be precast at division headquarters by maintenance forces. The individual units should be constructed so that the maintenance forces can place them by hand, as the expense of a derrick and work train is not warranted on this class of work.

In general, it is not economical to put better ma-

terial in bulkheads than is used in the remainder of the structure. For untreated pile trestles on branch lines, it is preferable to use second-class or once-used timber. Where trestles are of semi-permanent construction, such as creosoted ballast floor, the bulkheads should be built of creosoted timber or concrete slabs.

Ballast for Ballast Deck Bridges

What is the best ballast for ballast deck bridges, from the standpoint of its effect on the deck, where either concrete or treated timber is used?

Crushed Stone or Slag Is Best

By C. C. WESTFALL
Engineer of Bridges, Illinois Central, Chicago

Our experience indicates that crushed stone or slag is the best ballast for ballast deck bridges, whether the decks are concrete slabs or treated timber. This type of ballast affords good drainage, which is a very important item on a ballast deck bridge. It also stays in position and holds the track in satisfactory line and surface. We have found it necessary to remove other types of ballast from many of our bridges, and to replace them with crushed stone or slag.

Any Well-Draining Balast Is Satisfactory

By ASSISTANT BRIDGE ENGINEER

We have found that the main requisite for ballast for either concrete or treated timber decks is that it drain well and for that reason we use a variety of materials for ballast deck bridges on our line, the choice depending principally on the availability and cost. Thus, in certain localities we use crushed slag and in others crushed stone, pit gravel, and washed gravel are utilized for this purpose, depending on their relative costs.

The crushed slag is perhaps the best of these ballasts since it does not disintegrate under traffic and thus affords good drainage at all times, while certain limestones will become abraded under traffic, forming a dust which fills the voids between the stones.

C. B. & Q. Plants Hedges in Nebraska

THE Chicago, Burlington & Quincy recently inaugurated some experiments in tree planting at a number of points on its lines in western Nebraska, which are being made for the dual purpose of protecting the right-of-way from drifting snow and sand, as well as to co-operate in the movement among the citizens to increase the number of trees in that part of the state. It is expected that the results obtained will demonstrate the varieties best suited to localities with limited rainfall, and thus encourage the owners of nearby land to undertake more extensive plantings of their own.

A total of 7,000 trees were set out, and, with the exception of three places, the plantings were made on ground which had been in cultivation for a number of years. In every case, the ground was well prepared, and it is planned to cultivate the trees to keep out all other vegetation. Caragana and box elder predominate in the varieties used, which include also jack pine, Scotch pine, Russian mulberry; Russian olive, green ash,

A Section Gang Planting a Hedge
This planting consists of two rows of caragana and one row of Chinese elm and jack pine along the right-of-way fence near Wallace, Neb.

Chinese elm and American elm. Indicative of the results which may be expected of tree culture in this territory is the illustration showing a Russian olive hedge planted eight years ago on a farm near Grant, Neb. This hedge received no moisture except the natural precipitation, but was cultivated every year except during the fifth and sixth years when the owner was absent.

All of the trees planted by the Burlington were year-old seedlings which were furnished by the Forestry department at the cost of handling. The work is being carried on under the charge of Fred L. Taylor, agri-

A Hedge of Russian Olive Near Grant, Neb.
The trees in this hedge are planted about four feet apart in two rows spaced the same distance. Planted in 1920, they now give complete protection as a snow fence.

cultural agent of the Burlington with headquarters at Denver, Colo. The planting and cultivation of the trees is looked after by the maintenance of way forces, and there is said to be keen competition between the different gangs to secure the best stand of trees. The success of the experiments will make it possible to substitute natural hedges for many of the present board snow fences which are expensive to maintain and which detract from the appearance of the right-of-way.

Myers-Whaley Mucking Machine in the Great Northern's Cascade Tunnel

New and Improved Devices

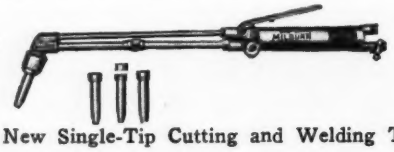
A New Asphalt Paint

A NEW asphalt paint has been developed by the Paint and Varnish division of E. I. du Pont de Nemours & Co., Wilmington, Del., which is said to be effective in protecting bridges and other steel or iron structures from corrosion, especially where they are exposed to locomotive smoke and gases, and also for protecting bridge timbers from decay.

In the preparation of this paint, which is called asphalt chromate emulsion, asphalt is combined mechanically with water to form an emulsion, to which chromium salts are added for the purpose of rendering ferrous metals passive to corrosion while the water of the emulsion is drying out. When dry, the coating is said to have all the properties of pure asphalt. The paint, which is used cold, may be applied with either a brush or a spray gun, and its freedom from toxic fumes or inflammable vapors permits its use in confined spaces.

A New Single-Tip Torch for Cutting and Welding

THE Alexander Milburn Company, Baltimore, Md., has recently developed a new type combination cutting and welding torch, designed specifically to speed up cutting and welding operations and to save both labor and gases. The outstanding feature of this new torch, which is known as Type TI, is an adjustable tip which can be adapted for both cutting and welding work. In one position of the tip, the gases are passed through the preheating gas passages while the high pressure oxygen used in cutting work is carried through the central hole. In a second position of the tip, made by



The New Single-Tip Cutting and Welding Torch

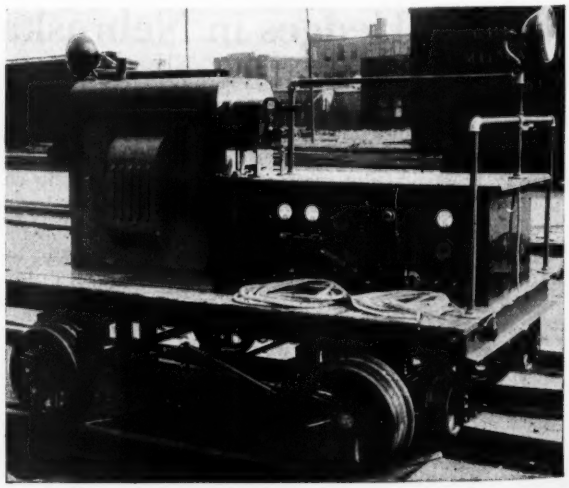
giving it a quarter turn, the cutting oxygen is cut off and the welding gases are conveyed through the central passage of the cutting tip to make a welding flame.

The new combination cutting and welding torch has all of the qualities of other types of Milburn combination torches, with the additional advantage mentioned above, which makes it unnecessary to purchase two sets of tips, and saves the time formerly lost while changing tips or torches. In the new torch, the Milburn principle of super-mixing has been retained, and the new tip has been specially constructed so that even when it has outlived its usefulness as a cutting tip, it is still serviceable as a welding tip. Flash-back is said to be eliminated, even though the tip should be inserted in molten metal.

A Welding and Grinding Car for Track Work

A SELF-PROPELLED electric welding machine, designed specifically for both arc welding and grinding work on and about railway tracks, has been developed recently by the Wilson Welder & Metals Co., Inc., Hoboken, N. J. In this new machine, a standard Wilson Model S welding generator, driven by a Continental gasoline engine through a flexible coupling, supplies all of the power required for driving the car, welding, and for lighting. A 3.5-kw., 110-volt, generator, connected directly to the welding current generator by a flexible coupling, supplies power for operating any make of grinder. The new machine provides a welding range of from 10 to 300 amperes at 25 volts, and welding, up to 200 amperes, and grinding can be carried on simultaneously.

The complete welding and grinding outfit, with the



The New Self-Propelled Welding and Grinding Car

motor, is mounted on a welded steel car, with pressed-steel, roller-bearing wheels. Brake shoes operate on all four wheels, and a special device for derailing is provided which consists of four small wheels mounted transversely behind the larger wheels. These wheels are used in connection with portable derailing rails, and make it possible to roll the car quickly into the clear.

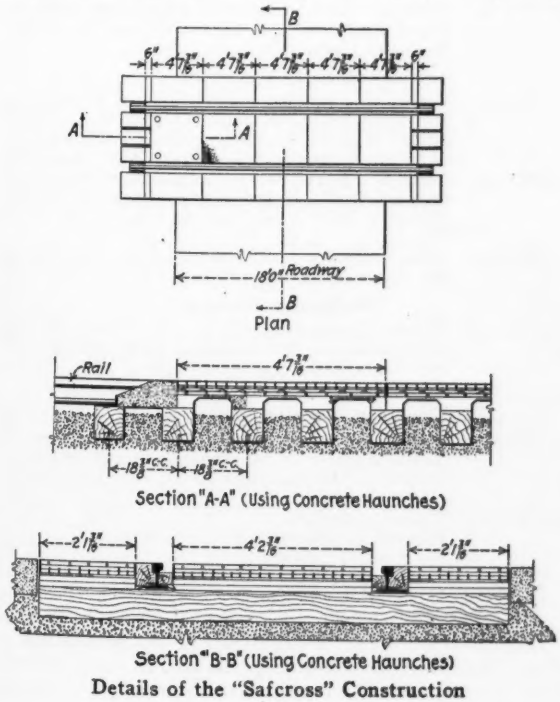
The fully-equipped car will run at a speed of from 12 to 15 miles per hour on level tangent track, the motive power being supplied by a standard electric automobile motor, chain-geared to the rear axle. This motor is controlled by a conveniently located "dead hand" handle, which operates both forward and reverse.

In order that the units may be used at night, the car is fitted with both head and tail lights, and is also equipped with facilities for operating a floodlight. The car is supplied with a large tool box, and removable top and sides are furnished to protect the generators and panels from the weather. These are entirely separate from the permanent metal hood with removable sides, which encloses the gasoline engine. The car seats four men comfortably, and has a total weight of 3,000 lb.

New Reinforcing for Concrete Slab Crossings

THE Irving Iron Works Company, Long Island City, N. Y., has developed a new type of reinforcement and surface armor designed specifically for use in the manufacture of precast concrete slabs for railroad—street or highway crossings. This new product, which is known as "Irving Safcross," embodies the principles of a system of reinforcement and surface armor developed for concrete bridge flooring, and consists of a top and a bottom panel of Irving open steel flooring, known as "Subway," united by means of shear members, in a self-supporting steel unit.

Safcross is ordinarily furnished in sections 4 ft. 7 3/16 in. long by 4 ft. 2 3/16 in. wide for paving between track rails, and in sections 4 ft. 7 3/16 in. long by 2 ft. 1 3/16 in. wide for the paving outside of the track rails; however, it can be furnished in units of any specified size. Manufacture of the concrete crossing sections is left to the railroads. This consists merely of filling the units of reinforcing with concrete and troweling off flush with the top edges of the upper steel bars.

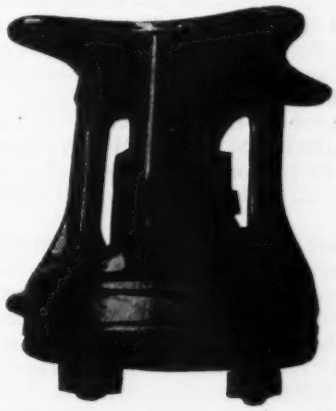


Details of the "Safcross" Construction

Ordinarily, the finished slabs are laid directly in the track on blocking laid longitudinally over the top face of each tie, but a number of other methods can be used if desired. The slabs are anchored in place by four lag screws which pass through holes provided in the slabs during manufacture. When the screws are in place, a recess in the top of the holes. provided to countersink the screw head, is sealed with an asphaltum material. Along both sides of each track rail, timber filler blocks are recommended, while heavy timbers or special concrete blocks with beveled upper faces can be used along both sides of the crossing to protect the concrete slabs from the impact of approaching vehicles.

An Adjustable Switch Lamp Socket

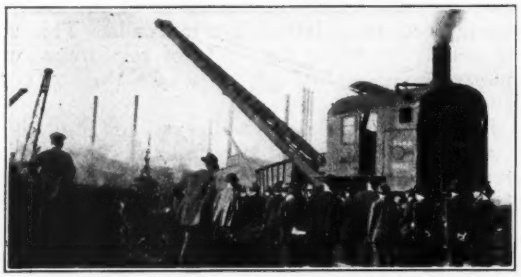
A REMEDY for tilted switch lamps has been developed recently by the Dressel Railway Lamp & Signal Company, Arlington, N. J., in the form of an adjustable switch lamp socket, through which correction can be made for even the most extreme cases of crooked or tilted switchstand stubs. The new socket consists essentially of four parts, an outer and an inner frame, which are separated by two wedge-shape flat rings or discs, placed horizontally between them. All four of these parts are held in position by two bolts, which pass through the center of the two discs and join the two frame parts.



The Adjustable Switch Lamp Socket

Adjustment of a crooked stub with this device requires only the use of a wrench. After the adjustable socket has been fastened to the switch lamp base, it is placed upon the tilted switchstand lamp stub and the two bolts of the socket are loosened. The two discs are then turned into such a position as to bring the lamp vertical, this being done by tapping the projections provided on the discs with a wrench. When the lamp is vertical, the nuts on the two assembly bolts are tightened and the lamp can then be removed and replaced on the same stub without interference with the adjustment.

With the Associations



American Railway Engineering Association

Three committees have have held meetings during the past month, all at Chicago. The Committee on Economics of Railway Labor met on August 13, the Committee on Water Service on August 21, and the Committee on Grade Crossings on August 24. The proceedings of the March convention have come from the printer and have been distributed to the members. The Board of Direction will hold a meeting in September on a date and at a place not yet selected.

Bridge and Building Association

Reports of all of the committees have now been completed and placed in the hands of the secretary, insuring their distribution among the members well in advance of the convention. This is the first year in the history of the convention when all of the reports have been completed so early.

For the convenience of those members living in the Central and Middle West, and through the courtesy of the Canadian National, the Central Vermont and the Boston & Maine railways, a special train will be provided leaving Chicago on Sunday morning, October 21, and traveling via Toronto and Montreal, arriving at Boston Monday evening. Requests for reservations for space on this train should be sent to C. A. Lichty, secretary, 319 Waller avenue, Chicago.

The Bridge and Building Supply Men's Association will present a more than usually complete exhibit at this convention. Although notices were sent to interested companies only a short time ago, 25 companies have already made reservations for space for the presentation of exhibits. These companies include the following:

American Hoist & Derrick Company, St. Paul, Minn.
American Railway Hydrant & Valve Company, Stapleton, S. I., New York.
A. M. Byers Company, Pittsburgh, Pa.
Carter Bloxonend Flooring Company, Kansas City, Mo.
Dearborn Chemical Company, Chicago.
Detroit Graphite Company, Detroit, Mich.
The DeVilbiss Company, Toledo, Ohio.
Paul Dickinson, Inc., Chicago.
Joseph Dixon Crucible Company, Jersey City, N. J.
Fairbanks, Morse & Co., Chicago.
The High Grade Mfg. Company, Cleveland, Ohio.
The Insulite Company, Chicago.
The Jones Paint Company, Rome, N. Y.
Johns-Manville Corp., New York.
Kaustine Company, Inc., Perry, N. Y.
The Lehon Company, Chicago.
Massey Concrete Products Corp., Chicago.
National Lead Company, New York.
Jos. E. Nelson & Sons, Chicago.
W. W. Patterson Company, Pittsburgh, Pa.
Pittsburgh Plate Glass Company, Newark, N. J.
Pocket List of Railroad Officials, New York.
Wm. Robertson & Company, Chicago.
Simmons-Boardman Publishing Company, New York.
U. S. Wind Engine & Pump Company, Batavia, Ill.

The Roadmasters' Association

The program for the forty-sixth annual convention, which will be held at the Book-Cadillac Hotel, Detroit, Mich., on September 18-20, is now completed. The reports of all of the committees have been finished and transmitted to the secretary. These reports, together with special addresses, assure a meeting of high order. The program is as follows:

(Eastern Standard Time)

Tuesday Morning, September 18

10:00 a. m. Convention called to order.
10:10 a. m. Opening address: C. G. Bowker, general manager, Grand Trunk Western, Detroit, Mich.
10:30 a. m. President's address: J. P. Davis, engineer maintenance of way, Central Indiana, Anderson, Ind.
10:50 a. m. Appointment of committees.
11:00 a. m. Report of committee. The Care of Winter-Laid Rail; M. J. Nugent, assistant engineer, Delaware & Hudson, Albany, N. Y., chairman.

Tuesday Afternoon

2:00 p. m. Report of committee: The Programming of Section Work; J. J. Desmond, roadmaster, Chicago Terminal Division, Illinois Central, Chicago, chairman.
3:00 p. m. Address: Permanent Track Construction on the Pere Marquette, Paul Chipman, valuation engineer, Pere Marquette, Detroit, Mich.
4:00 p. m. Adjournment to visit exhibit of the Track Supply Association.

Tuesday Evening

8:00 p. m. Safety in Track Work.
Moving Pictures.
Address: C. E. Hill, general safety agent, New York Central, New York City.

Wednesday Morning, September 19

9:30 a. m. Report of committee: The Conservation of Revenue-Earning Equipment in the Handling of Maintenance of Way Materials; R. H. Smith, division superintendent, N. & W., Roanoke, Va., chairman.
10:30 a. m. Address: The Problem of Maintaining a High-Speed Railway; J. F. Deimling, chief engineer, Michigan Central, Detroit, Mich.

Wednesday Afternoon

2:00 p. m. Report of committee: Methods of Preventing and Overcoming Damage to Rail Ends; C. F. Allen, division engineer, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis., chairman.
3:00 p. m. Address: Notes on the Manufacture and Service of Rails; C. B. Bronson, assistant inspecting engineer, New York Central Lines, New York City.
4:00 p. m. Adjournment to visit exhibit of the Track Supply Association.

Wednesday Evening

6:30 p. m. Annual banquet given by the Track Supply Association to the members of the Roadmasters' Association and their families.
Addresses by prominent railway officers.

Thursday Morning, September 20

9:30. a. m. Report of committee: The Organization of Track Forces; A. A. Johnson, track engineer, Delaware, Lackawanna & Western, Hoboken, N. J., chairman.
10:30 a. m. Business session.
Reports of officers and of committees.
Election of officers.
Selection of 1929 convention city.
Installation of officers.
Adjournment.

The Track Supply Association is contemplating a more than usually complete exhibit. A total of 62 firms have already arranged to exhibit their mate-

rials, as compared with 56 a year ago. In addition to those listed in the July issue, page 316, the following companies have since taken space:

Ames Shovel & Tool Co.
Chase Appliance Company.
Electric Tamper & Equipment Co.
Thomas A. Edison, Inc.
National Highway Crossing Company.
Reade Manufacturing Company.
Sellers Manufacturing Company.
The United States Graphite Company.
Warren Tool & Forge Co.
Wyoming Shovel Works.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 23-25, 1928, Hotel Statler, Boston, Mass.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April, 1929.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 18-20, 1928, Book Cadillac Hotel, Detroit, Mich.

Track Supply Association.—A. H. Told, secretary, Positive Rail Anchor Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

The Material Market

AUGUST was a quiet month with "business as usual" but with no startling developments. If it were to be characterized as distinctive in any respect, it would be from the standpoint of stability of prices in all lines covered on this page. There were no changes in iron and steel prices of interest to the maintenance of way man and only relatively moderate fluctuations in lumber.

No rail orders as large as those noted during July were consummated in August, but a considerable number of smaller tonnages were placed. The Wheeling & Lake Erie ordered 3,500 tons; the Southern, 1,750 tons; the St. Louis Southwestern, 2,000 tons; and two western roads, 4,000 and 3,000 tons respectively. These and other orders received by the mills during the month were effective in keeping production at a rate of about 50 per cent of capacity, pending the opening of the regular season of rail buying sometime during the present month. Purchases of track accessories have been in sufficient volume to keep the plants operating at a rate of from 50 to 75 per cent of capacity, but no larger orders were placed during the month.

Railroad buying has been more of a factor in the steel market by reason of orders placed, or in prospect, for cars and locomotives, the former in particular having an influence on the demand for steel plates. Prices for structural steel seem now to be definitely established at $1.90 and $2.00 per 100 lb., at Pittsburgh and Chicago, respectively, it being contended that the only material moving at lower prices is such as has been specified against old orders. Wire prices are also steady at the new lower rates established a month ago, reports of concessions being confined to one restricted locality. Track material prices have been subject to no change.

Scrap prices have a stronger tone in practically all markets, and the railroads are taking advantage of this change by disposing of the accumulations of old material. In the St. Louis market alone offerings of scrap from 11 railroads during a recent week totaled nearly 50,000 tons.

Lumber sales in all of the leading fields continue to exceed production, totaling 8,905 million feet b.m., for all soft wood operations covered by the statistics of the National Lumber Manufacturers' Association, for the first 31 weeks of 1928, as compared with a production of 8,207 million feet. As shipments totaled 8,756 million feet, there has been a definite reduction in stocks. The situation is most pronounced with respect to the operations of mills covered by the reports of the Southern Pine, West Coast and Western Pine Associations which produce 80 per cent of the soft wood lumber. Southern pine operations have been curtailed recently by heavy rains and in the Southeast by tropical storms.

Summer is the season of greatest demand for portland cement. Statistics of operations for July show that a production of 17,431,000 bbl. or 87 per cent of capacity was exceeded by shipments, which amounted to 19,898,000 bbl., thereby reducing stocks on hand from 25,021,000 bbl., at the end of June to 22,571,000 bbl., at the end of July. Stocks, however, are still 16.4 per cent higher than a year ago. There have been no changes in prices during the past month at the distributing centers listed below. The prices given are for carload lots not including the charge for bags not returned.

New York	$2.03	Minneapolis	$2.22
Pittsburgh	2.04	Denver	2.85
New Orleans	2.40	Dallas	2.40
Chicago	2.05	San Francisco	2.41
Cincinnati	2.22	Montreal	1.41

Iron and Steel Prices Per 100 Lb.

	July				August			
	Pittsburgh		Chicago		Pittsburgh		Chicago	
Track spikes		$2.80		$2.80		$2.80		$2.80
Track bolts		3.80		3.80		3.80		3.80
Angle bars		2.75		2.75		2.75		2.75
Tie plates, steel		2.15		2.15		2.15		2.15
Boat spikes		3.00		3.00		3.00		3.00
Plain wire		2.40		2.45		2.40		2.45
Wire nails, keg		2.55		2.60		2.55		2.60
Barb wire, galv.		3.20		3.25		3.20		3.25
C. I. pipe, 6 in. to 12 in. ton				$40.20 to 43.20				$42.20 to 43.20
Plates		$1.85 to 1.90		2.00		1.90		2.00
Shapes		1.85 to 1.90		2.00		1.90		2.00
Bars, soft steel		1.85 to 1.90		2.00		1.90		2.00
Rivets, struc.		2.90		3.00		2.90		3.00
Con. bars, billet	1.95 to	2.00			$1.95 to	2.00		
Con. bars, rail		1.75		1.85		1.75		1.85
Rails per gross ton f.o.b. mills		43.00		43.00		43.00		43.00

Scrap Prices Per Gross Ton at Chicago

	July	August
Relaying rail (including angle bars)	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	14.75 to 15.25	14.75 to 15.25
Rails less than 3 ft. long	15.25 to 15.75	15.25 to 15.75
Frogs and switches cut apart	13.50 to 14.00	13.75 to 14.25
Steel angle bars	14.25 to 14.75	15.00 to 15.50

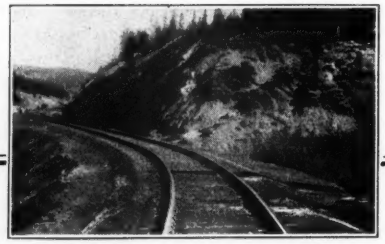
Southern Pine Mill Prices

	July	August
Flooring, 1x4, B and better, flat	$38.82	$39.54
Boards, 1x8, No. 1	32.68	32.87
Dimension, 2x 4, 16, No. 1, common	27.72	28.18
Dimension, 2x10, 16, No. 1, common	29.78	28.89
Dimension, 2x 4, 16, No. 2, common	23.72	24.82
Dimension, 2x10, 16, No. 2, common	25.00	25.59

Douglas Fir Mill Prices

	July	August
Flooring, 1x4, B and better, flat	$34.50	$24.50
Boards, 1x8, No. 1	16.50	17.50
Dimension, 2x 4, 16, No. 1, common	18.25	18.75
Dimension, 2x10, 16, No. 1, common	18.25	18.50
Dimension, 3x3, to 4x12, No. 1 common	19.75	19.50
Dimension, 5x5, to 12x12, No. 1, common rough	17.75	16.50

Railway News



Briefly Told

The Railroad Commission of Texas, in its annual report for 1927, recommends the adoption of a 10-year program for the elimination of grade crossings on the highways in that state. During 1927, there were 272 grade crossing accidents in Texas, resulting in the death of 105 persons and the injury of 350 others.

Two fellowships in timber research are open at Washington University, St. Louis, Mo. for the school year 1928-29. These fellowships, which have been established by the American Creosoting Company, Louisville, Ky., and which pay $1,000 annually in addition to tuition, are under the direction of J. L. VanOrnum of the department of engineering. In making the awards, engineers who have had one or more years of laboratory work will be given preference.

Revenue freight car loadings have shown an upward trend since July 1, and from that time to August 11, the latest date for which figures are available, the total cars loaded amounted to 4,991,553 as compared with 4,937,799 for the corresponding period in 1927, an increase of 53,754 cars. The cumulative total for the first 32 weeks of this year is 30,493,100, as compared with 31,286,341 for the corresponding period in 1927, and 31,298,302 in the same period in 1926.

Trackmen and maintenance of way employees of the Pennsylvania, to the number of 22,000, are to be granted increases of pay ranging from one cent an hour to $17 a month, according to a statement issued as coming from Calvin W. Long, chairman of the board representing the employees. The increases are said to be based on the decision of a conference between officers of the road and representatives of the men, which was held at Harrisburg, Pa., and which ended on August 1.

The Pittsburgh & West Virginia, in opposing petitions filed with the Interstate Commerce Commission by the Baltimore & Ohio, the Pennsylvania and the New York, Chicago & St. Louis, which asked for a rehearing and reconsideration of the decision of the commission authorizing the P. & W. V. to build an extension from Cochran's Mill, Pa., to Connellsville, and thereby closing a gap between lines extending from Baltimore to the Ohio river, takes the position that the commission may not now recall the certificate because work had been started on the extension before the filing of the petitions of the opposing roads. If, however, the commission does not agree with this contention, request is made that a hearing be had on the question of the propriety and power of the commission to vacate the certificate and order in question.

The Southern Pacific, in securing preliminary data for the construction of its proposed bridge over Carquinez straits in California, used an airplane which flew over the site of the bridge at elevations ranging from 200 ft. to more than 5,000 ft. C. R. Harding, engineer of standards, who made the inspection, stated that it was possible in this way to obtain a more comprehensive view than otherwise would be possible, and that bars and other obstructions under water could be seen with ease.

When high water flooded the highways in certain parts of Arkansas during the last week in June and the first week in July, the railroads came to the aid of the automobilists by establishing shuttle trains to transport their cars over the flooded areas, these trains consisting of flat cars on which the automobiles were loaded by means of ramps. The Missouri Pacific operated such a service between Wynne and Bald Knob, 45 miles, from June 23 to July 6, during which time it carried 611 autos and 1,399 persons. A similar service was operated by the Chicago, Rock Island & Pacific between Brinkley and De Vall's Bluff, 15 miles, when the main highway between Memphis, Tenn., and Little Rock, Ark., was submerged from July 2 to July 9, during which time 1,360 autos and 2,623 persons were transported.

The Steam Railroad Section of the National Safety Congress will meet at the Waldorf-Astoria Hotel in New York on October 2, 3 and 4. Among the speakers will be L. G. Bentley, general safety agent, Chesapeake & Ohio, who is also chairman of the Committee on Education of the Safety Section of the American Railway Association, Richmond, Va.; F. P. Brennan, supervisor of safety, Long Island, New York; S. H. Osborne, engineer maintenance of way, Union Pacific, Omaha, Neb., C. T. Bailey, chief safety agent, Oregon Short Line, Salt Lake City, Utah. H. M. Mayo, superintendent of safety, Southern Pacific Lines in Texas & Louisiana, Houston, Tex., J. E. Long, superintendent of safety, Delaware & Hudson, Albany, N. Y., W. L. Roller, engineer maintenance of way, Hocking Valley, Columbus, Ohio, and J. L. Walsh, superintendent of safety, Missouri- Kansas-Texas, Dallas, Tex.

The railway labor unions of Great Britain have agreed with the four amalgamated railway companies to accept a wage reduction of 2½ per cent for all classes of employees, and the directors and chief officers of the companies have accepted a like reduction in their salaries. The reduction became effective August 13, and will continue in effect for 12 months, unless terminated sooner by either party to the agreement on three months notice. The reduction will reduce the railway payroll £2,500,000 (about $12,500,000) and will aid in rehabilitating the general credit of the roads. More than 650,000 employees of the four companies are affected by the agreement.

The Order of Railway Conductors and the Brotherhood of Railroad Trainmen, following the refusal of the western railways to accede to their demands for a 7½ per cent increase in pay without any changes in the rules, called for a strike vote of their members on these roads on August 14. The vote is returnable September 2. In their negotiations with the employees the roads offered an advance in pay of 6½ per cent without any changes in the rules, or of 7½ per cent if certain restrictive rules not in effect in other territories were eliminated, either of which offers would have raised the wage rates above the highest previous rates ever paid. The representatives of the employees refused to accept either of these offers or to submit them to arbitration. Prompted by concern over the threatened interruption to transportation, the Duluth Board of Trade, the Duluth Traffic Commission, the iron ore interests and other shippers at Duluth, Minn., the Illinois Manufacturers' Association, the St. Paul Association and shippers of St. Paul, Minn., and representatives of the shippers of Kansas City, Mo., have asked the United States Board of Mediation to take immediate action and call on President Coolidge to appoint a special board to act in the emergency. At the summer White House at Superior, Wis., it was announced that although communications from private sources have reached President Coolidge, requesting him to act, he is leaving the matter entirely in the hands of the mediation board.

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract to the Flick Construction Company, Chicago, for the grading, ballasting and track laying on a line between Cheyenne, Okla., and Pampa, Tex., 85 miles. This line is being constructed as an extension of the Clinton & Oklahoma Western and will connect with the Higgins (Tex.)-Clovis (N. M.) line of the Panhandle & Santa Fe at Pampa.

A contract has been awarded to Jerome A. Moss, Chicago, for the construction of a subway at Cicero avenue, Chicago, to cost $80,000. A contract has been awarded to Johnson & Beck, Topeka, Kan., for the installation of piping in the yards, for yard supply and fire protection, at Emporia, Kan., to cost $80,000. A contract has been awarded to the Ogle Construction Company, Chicago, for the construction of a 500-ton, three-track, reinforced concrete coaling station, in which will be included a complete gravity sand handling plant, at Syracuse, Kan.

The Baltimore & Ohio is receiving bids for a 14,000-gal. per hour water treating plant at Morgantown, W. Va.

The Beaver, Meade & Englewood has awarded a contract for the construction of an extension from Hooker, Okla., to a point 20 miles west to the Panhandle Construction Company, Oklahoma City, Okla., at a cost of about $445,000.

The Bellefonte Central has been authorized by the Interstate Commerce Commission to construct a 6-mile line between Struble, Pa., and Fairbrook.

The Buffalo, Rochester & Pittsburgh has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of an "N. & W." type electric coaling station at Bradford, Pa.

The Central Vermont has awarded a contract to the Roberts & Schaefer Company, Chicago for the construction of a 300-ton capacity, 3-track, reinforced concrete, coaling station and sanding plant and a cinder plant at White River Junction, Vt.

The Chesapeake & Ohio has authorized a contruction program involving proposed expenditures totaling more than $21,000,000. At Huntington, W. Va., work which is estimated to cost $9,635,000 is planned. This includes $5,900,000 for additional main tracks, a $3,500,000 extension to the locomotive repair shops and a $235,000 addition to the hospital. An expenditure of $3,160,000 is authorized for a new freight car repair shop yet to be located, while approximately $2,300,000 is to be spent on the construction of a new engine terminal and other improvements at Cincinnati, Ohio.

Second track, planned in various localities, is expected to cost $1,300,000, while $1,260,000 is the estimated cost of additional shop improvements and tracks at Hinton, W. Va.

At Richmond, Va., $1,000,000 is authorized for additional shop improvements, while a like expenditure for similar work at Clifton Forge, Va., is planned.

Various other improvements, including depots, elimination of grade crossings, additional tracks, etc., are expected to cost $989,724.

Work will proceed as soon as permission is obtained from the Interstate Commerce Commission to capitalize past expenditures for improvements for the purpose of reimbursing the company's treasury.

The Chicago, Burlington & Quincy has awarded a contract to the Ogle Construction Company for a 200-ton capacity, electrically operated timber coaling station in Kansas City, Mo. A contract was also awarded to the Pittsburgh-Des Moines Steel Company for the construction of a water treating plant of 500,000 gal. per day capacity at Centralia, Ill.

The Chicago, Rock Island & Pacific has applied to the Interstate Commerce Commission for authority for the construction of an extension from Quinn, Ark., in a southeasterly direction about 6 miles. A contract has been let to the Railroad Water & Coal Handling Company, Chicago, for the construction of fuel oil stations at Bucklin, Kan., and Hutchinson. A contract for the construction of grade separation structures in the vicinity of Ninety-fifth and Yates Ave., Chicago, has been let to Jos. E. Nelson & Sons, Chicago, at a cost of about $90,000.

The Cincinnati, New Orleans & Texas Pacific closed bids August 23 for the construction of second track on 35 miles of line from Lexington, Ky., to Danville.

The Colorado & Southern has let a contract to the Roberts & Shaefer Company, Chicago, for the construction of a two-track electric cinder plant at Denver, Colo.

The Delaware & Hudson opened bids on July 18 for the elimination, by underpass construction, of the Delmar-Elemere grade crossing in Albany county, N. Y., the estimated cost of which, exclusive of land damage, is $154,700. The land to be taken has been appraised at $18,400. The bids are subject to approval by the Public Service Commission.

The Delaware, Lackawanna & Western contemplates the erection of a series of warehouses in Jersey City, N. J. Preliminary plans for the work, which is expected to cost approximately $10,000,000, are now in preparation.

The Edward Hines Western Pine Company has applied to the Interstate Commerce Commission for permission either to construct a new line or to acquire an existing line between Burns, Harney county, and Seneca, Grant county, Oregon, a distance of 50 miles.

The Florida East Coast has applied to the Interstate Commerce Commission for permission to construct a branch line from Belleglade 9½ miles to a point on the west bank of the Miami canal, in Palm Beach county, Fla.

The Georgia Southwestern & Gulf has applied to the Interstate Commerce Commission for authority to build an extension of 4 miles from Raines, Ga., to Armstrong.

The Grand Trunk Western has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 300-ton, four-track, electrically operated coaling station, in which will be incorporated reinforced concrete water storage tanks of 50,000 gal. capacity, at Lansing, Mich.

The Harbor Belt Line's purchase of 300 acres of land in Los Angeles, Cal., for $1,800,000, has been approved by the Board of Harbor Commissioners of that city. The land will be used for the future construction of a classification yard.

The Kansas City Southern has awarded a contract to the List Construction Company, Kansas City, Mo., for the grading and construction of bridges for a new line between Grandview, Mo., and Leeds, 13 miles, which will provide that road with an entrance to Kansas City over its own rails. The new line will cross 25 highways, at all of which the grades will be separated. The tracklaying and ballasting will be done by company forces. The cost of the entire project is estimated at $3,000,000.

The office of the United States District Engineer at Kansas City, Mo., has recommended to the War department approval of the plans of this company for the construction of a vertical lift bridge over the Missouri river at Randolph, Mo.

The Louisville & Nashville plans the construction of a two-story passenger station at Bay St. Louis, Miss., at a cost of about $50,000 to replace the building recently destroyed by fire. The station will have outside dimensions of 30 ft. by 125 ft. Tentative plans for a two-story freight and passenger station at Madisonville, Ky., to cost approximately $75,000 have been submitted to the Chamber of Commerce.

The Missouri Pacific has awarded a contract to the Ozark Engineering Company, Joplin, Mo., for the construction of a viaduct at Lincoln avenue in Little Rock, Ark.

A contract for the construction of a water treating plant at Coffeyville, Kan., including a frame pump house, has been let to the Railroad Water & Coal Handling Company, Chicago.

The Missouri Southern contemplates the construction of an extension from

a point near Bunker, Mo., west toward the Current river, about 12 miles, to provide an outlet for a section of virgin timber. The cost of the construction is estimated at $18,000 per mile.

The New York Central plans extensive improvements to the docks of the Ohio Central Lines at Toledo, O. The present concrete bulkhead is to be extended 2,500 ft. Approximately 250,000 cu. yd. of fill will be made and additional load and empty car yards will be built. An all-electric coal dumping machine will also be installed. The contract for the extension of the bulkhead and the hydraulic filling has been awarded to the Newton-Baxter Company of Toledo, O.

Bids were closed on August 14 for the construction of extensions to bridges to take care of additional tracks for the union station at Cleveland, Ohio.

A contract for the construction of a passenger station, drive-ways and platform at Goshen, Ind., has been let to the Ellington-Miller Company, Chicago, at a cost of about $50,000.

Six additional contracts have recently been awarded by this road. One, for the remodeling of transfer bridge "B" at 30th street, New York, went to the Jobson-Gifford Company, New York. A second, for the reconstruction of five ferry bridges, slips and ferry houses at Weehawken, N. J., was awarded to the Geo. W. Rogers Construction Corporation, New York, while a third, for additions and alterations to offices of the consolidated ticket office New York, was given to David Kramer, Inc., New York. A contract involving the manufacture, delivery and installation of conveyors for a grain elevator at Weehawken, N. J., was awarded to the M. A. Long Co., Baltimore, Md. Another for additions to the power house of the road at Harmon, N. Y., went to J. F. Fitzgerald Construction Company, Boston, Mass., while the sixth was awarded to Lyons-Slattery Co., Inc., New York, for the construction of a yard between W. 41st and W. 42nd street, along 11th and 12th avenues, New York.

The New York, New Haven & Hartford has awarded contracts to H. R. Kent & Co., Rutherford, N. J., for work in connection with the revision of heating plants at Van Nest, N. Y., and Harlem River, N. Y. The former is expected to cost approximately $140,000 and the latter about $60,000.

The Northern Pacific is completing plans for the construction of a shop at Laurel, Mont., to be used for the repair of steel cars, which is estimated to involve an expenditure of $160,000. Company forces are to be employed in the construction of a stockyard at Laurel to cost about $40,000.

The Pacific Electric has awarded a contract to the Lynch-Cannon Engineering Company, Los Angeles, Cal., for the construction of a double-track bridge over the Los Angeles river on the Glendale line, to cost $130,000.

The Pennsylvania has recently awarded contracts involving estimated expenditures of $430,000; the largest, involving $310,000, was awarded to Newton A. K. Bugbie & Co., Inc., Trenton, N. J., for the erection of inbound and outbound freight houses, a bridge, platforms and shelters in connection with a new freight house at Trenton. A second contract, for steel work in connection with the auction house at the new produce terminal development in Pittsburgh, was awarded to the Jones & Laughlin Steel Corporation, Pittsburgh. Approximately $65,000 is involved in this contract. A third contract, for the construction of an undergrade bridge in connection with the elimination of a grade crossing on the Sherman-Mayville road, Mayville, N. J., was awarded to the Milliron Construction Company, Du Bois, Pa. The estimated cost of the work is $55,000.

Plans for the expansion and improvement of Grogan yard, in North Columbus, Ohio, call for an expenditure of $4,000,000 of which $1,000,000 has just been authorized by the board of directors. The improvement program includes the separation of five existing highway crossings—Cleveland avenue, Essex avenue, Field avenue, Eleventh avenue, and Seventeenth avenue, and a relocation of the main tracks serving the Toledo division to permit an extension of Grogan yard tracks westward to provide a capacity of 125 cars each.

Three contracts for bridge construction have recently been awarded by this road; the first, involving approximately $112,000, for the construction of an undergrade bridge at Charlotte avenue, Jersey City, N. J., was awarded to Henry Steers, Inc., New York, while a second, for an overhead bridge on Baldwin avenue, Jersey City, went to the Stillman-Delehanty-Ferris Company, Jersey City. Approximately $45,000 is involved in this contract. The third, for the reconstruction of an overhead bridge at Wallingford, Pa., was awarded to the Philadelphia Construction & Engineering Company, Philadelphia, Pa. This work is expected to cost about $17,000. The road also awarded a contract to the Belmont Iron Works, Philadelphia, for steel frame work in connection with the construction of a warehouse for the Universal Carloading & Distributing Company at Kearny, N. J.

The Pittsburgh, Libson & Western's application for authority to construct two extensions has been reported on favorably by C. V. Burnside, assistant director of the Bureau of Finance of the Interstate Commerce Commission. The proposed extensions are from Smiths Ferry, Pa., to Negley, Ohio, 13.3 miles, and from Mill Rock, Ohio, to a point in the vicinity of Youngstown, 28.4 miles, for the purpose of establishing a through route for the transportation of bituminous coal from the Pittsburgh and Connellsville districts to the Youngstown district, in connection with barge lines on the Ohio and Monogahela rivers.

The St. Louis-San Francisco (Muscle Shoals, Birmingham & Pensacola) has awarded a contract for the construction of a passenger station at Pensacola, Fla., to the W. Horace Williams Company, New Orleans, La., at a cost of about $100,000.

The St. Louis Southwestern expects to apply to the Interstate Commerce Commission immediately for permission to construct a line between Gideon, Mo., and Deering, 20 miles, and another line between Hornersville, Mo., and Leachville, Ark., 11 miles. The Gideon-Deering line is designed to provide a connection between the Gideon & North Island and the Deering Southwestern, while the Hornersville-Leachville line will connect the Paragould Southeastern with the Blytheville, Leachville & Arkansas Southern.

The Southern Pacific, in an application to the Interstate Commerce Commission, asks for certificates authorizing the construction of a line of 5.64 miles from San Jose to Lick Station, Cal., and the abandonment of 1.12 miles of line at San Jose. Construction of an extension from its line at Kerman, Fresno county, Cal., six miles, to a connection with the Fresno Traction Company at Biola is proposed in an application to the Interstate Commerce Commission.

The Texas City Terminal has awarded the general engineering and construction contract for improvements to rail and water facilities at Texas City, Tex., which are estimated to involve an expenditure of about $2,000,000 to the James Stewart Corporation, Chicago. This will include the remodeling of the grain elevator headhouse and the construction of a 900-ft. grain conveyor which will extend from the headhouse to the docks.

The Toronto Terminals are holding in abeyance the construction of an express and office building for the use of the Canadian Pacific at Toronto, Ont., for which bids were asked early in July and it is unlikely that work on this project will be undertaken during the year of 1928.

The Turlock & Eastern has been formed to construct a line between Turlock, Cal., and a connection with the Atchison, Topeka & Santa Fe at Cortez, about five miles. The cost of the line is estimated at $250,000.

The Union Pacific has awarded a contract to Ryberg-Sorenson, Inc., Salt Lake City, Utah, for the construction of a passenger station at Marysville, Kan.

The Wabash has awarded a contract to Dwight P. Robinson & Co., Inc., for the construction of a passenger station at Delmar boulevard and Hodiamont avenue, St. Louis, Mo. The estimated cost of the project is $350,000.

Supply Trade News

General

The L. B. Foster Company, Inc., has opened a St. Louis office at 1725 Railway Exchange building.

The American Rolling Mill Company, Middletown, Ohio, has awarded a contract to H. W. Cox, Ashland, Ky., for the construction of a one-story storage and distributing unit, 160 ft. by 270 ft., at Ashland, to cost $175,000.

Personal

A. W. MacLean has been appointed a special representative of the MacLean-Fogg Lock Nut Company, Chicago.

J. L. Lavallee has been appointed assistant district manager of the railway sales division of the Texas Company, with headquarters at New York.

Thomas G. Smallwood, district manager for the Chicago Pneumatic Tool Company, New York, whose headquarters were at Cincinnati, Ohio, died on July 20.

Paul Mackall has been appointed vice-president of the Bethlehem Steel Company in charge of general sales, succeeding **E. S. Kinsley,** who has retired to less active duties.

The Syntron Company, Pittsburgh, Pa., has appointed district sales managers, as follows: **R. M. Hibbs,** 1426 Fairmount avenue, Philadelphia, Pa.; **F. L. Johnson,** 2146 East Fourteenth street, Cleveland, Ohio; **G. A. McKee,** 1759 West Forest avenue, Detroit, Mich.; **William Heritage,** 3711 Delmar avenue, St. Louis Mo., and **C. W. Osborn,** 2404 Main street, Dallas, Tex.

John B. Tinnon, manager of the rail welding department of the Metal & Thermit Corporation, New York, with headquarters in that city, has been promoted to manager of sales of the Thermit department, with headquarters at the same point, to succeed **W. R. Hulbert,** resigned.

Mr. Tinnon, who received his technical education at Vanderbilt University, entered railway work in 1908 with the Chicago City Railway, where he served as an assistant engineer during the rehabilitation of that property. In 1912, he was appointed engineer of way of the Joliet & Chicago Electric Railway, remaining in that position until 1918, when he served in the ordinance department of the U. S. Army. In the following year, he returned to the Joliet & Chicago Electric as chief engineer and in 1924 was appointed manager of the rail welding department of the Metal & Thermit Corporation, which position he was holding at the time of his promotion, on August 1, to manager of sales of the Thermit department.

Personal Mention

General

Howard E. Stevens, chief engineer of the Northern Pacific, with headquarters at St. Paul, Minn., has been promoted to vice-president in charge of operation, with headquarters at the same point. Mr. Stevens was born on March 8, 1874, at Bluehill, Me., and was educated at the University of Maine, where he graduated in 1897. After the completion of his college course, he was engaged in surveying and bridge work until 1900, when he became associated with Ralph Modjeski, bridge engineer, in the design and construction of bridges, including, among other structures, the bridge over the Mississippi river at Thebes, Ill. Mr. Stevens entered railway service in 1904 as a draftsman in the bridge department of the Northern Pacific and later was advanced to assistant engineer, specializing in the design and erection of steel bridges. He was promoted to bridge engineer in February, 1907, with headquarters at St. Paul, and in October, 1916, he was further promoted to chief engineer, which position he was holding when he was promoted to vice-president in charge of operation on August 10.

Howard E. Stevens

D. E. Gelwix, division engineer of the Northern division of the St. Louis-San Francisco, with headquarters at Ft. Scott, Kan., has been promoted to maintenance assistant to the general manager, with headquarters at Springfield, Mo. Mr. Gelwix was born on February 14, 1887, at Thayer, Kan., and was educated at the University of Kansas. He entered railway service in September, 1912, as an assistant engineer on the Frisco and in 1916 was appointed valuation engineer of the Kansas City, Clinton & Springfield (now a part of the St. Louis-San Francisco). He returned to the Frisco in September, 1917, as an assistant engineer, and in December of the same year was promoted to office engineer in the chief engineer's office at St. Louis. In 1918 he was promoted to district engineer with headquarters at Springfield, Mo., and in 1920 was appointed division engineer of the Eastern division, with headquarters at the same point. Mr. Gelwix was later transferred to the Northern division at Ft. Scott, Kan., where he was serving at the time of his recent promotion to maintenance assistant to the general manager.

W. H. Marsh, principal assistant engineer of the Spokane, Portland & Seattle, with headquarters at Portland, Ore., has been promoted to assistant to the president to succeed **F. S. Biays,** who has been assigned to other duties. Mr. Marsh was born on November 7, 1882, at Marseilles, Ill., and was educated at the University of Illinois, where he graduated in 1904. His early railway experience was gained with the Chicago & Eastern Illinois and the Illinois Traction System. He entered the employ of the St. Louis-San Francisco and a year later became an assistant engineer on the Chicago, Ottawa & Peoria, a part of the Illinois Traction System.

W. H. Marsh

He became an assistant engineer on the Oregon Short Line in 1909, and in September, 1912, entered the service of the Spokane, Portland & Seattle in the same capacity. Mr. Marsh was promoted to principal assistant engineer on January 1, 1918, which position he was holding at the time of his recent promotion to assistant to the president.

W. R. Triem, superintendent of the Buffalo division of the Pennsylvania, an engineer by education and experience, has been promoted to superintendent of freight transportation of the Central region of the Pennsylvania. Mr. Triem was born on October 21, 1886, at Allegheny, Pa., and graduated from the Ohio State University in 1910. He entered railway service in the same year as an assistant in the engineering corps on the Marietta division of the Pennsylvania, later serving in the same capacity on the Toledo division. He was assigned to construction work at Delaware, Ohio, in 1916, and two years later was promoted to assistant engineer on the Akron division with headquarters

at Akron, Ohio. In 1920, Mr. Triem was promoted to assistant division engineer of the Logansport division, with headquarters at Logansport, Ind., remaining in this position until 1924, when he entered the operating department as assistant trainmaster on the Toledo division, with headquarters at Toledo, Ohio. He was later promoted to assistant superintendent and superintendent, respectively, and was holding the latter position at the time of his recent promotion to superintendent of freight transportation of the Central region.

Robert V. Massey, assistant vice-president in charge of personnel of the Pennsylvania, with headquarters at Philadelphia, Pa., an engineer by education and experience, has been promoted to vice-president in charge of personnel, with the same headquarters. Mr. Massey was born on September 29, 1871, at Dover, Del., and graduated from the Sheffield Scientific School at Yale University in 1892. He entered railway service on September 1, 1892, in the construction department of the Pennsylvania, and in August, 1895, was transferred to the maintenance of way department, at Altoona, Pa. In November of the same year, he was promoted to assistant supervisor at Freeport, Pa., subsequently being transferred to Baltimore, Md., and Mifflin, Pa. He was promoted to supervisor on the Schuylkill division on April 1, 1899, and later served in the same capacity on the Philadelphia, Baltimore & Washington (now a part of the Pennsylvania), and at Pittsburgh, Pa. Mr. Massey was promoted to division engineer of the Schuylkill division on April 1, 1907, and was transferred to the New York di-

Robert V. Massey

vision on January 1, 1909. He entered the operating department in March, 1911, as superintendent of the New York, Philadelphia & Norfolk, and the Cape Charles (now parts of the Pennsylvania) with headquarters at Cape Charles, Va., and on February 14, 1914, was transferred to the Manhattan division, with headquarters at New York. He was promoted to general superintendent of the Eastern Pennsylvania division, with headquarters at Altoona, Pa., in June, 1917, and was transferred to the New Jersey division on July 1, 1918. He was promoted to assistant general manager of the Eastern region on March 1, 1920, and three years later was advanced to general manager of the same region. In September, 1926, Mr. Massey was promoted to assistant vice-president in charge of personnel, which position he was holding at the time of his advancement to vice-president in charge of personnel on August 1.

Alexander C. Shand, formerly chief engineer of the Pennsylvania system, and more recently assistant to Vice-President Elisha Lee in the engineering problems connected with the con-

Alexander C. Shand

struction of the new station at Philadelphia, Pa., retired from active duty on August 1, under the pension regulations, after a service of almost 49 years with that road. Mr. Shand was born on July 1, 1858, at Lesmahagow, Scotland, and was educated at Anderson University, Glasgow. He entered railway service in 1879 on location and construction work on the Pennsylvania at Connellsville, Pa., and shortly after was placed in charge of the construction of the Torrens shops. From February, 1882, to August, 1884, he was an assistant supervisor and engineer in charge of the location and construction of branches on the Southwest Pennsylvania (now a part of the Pennsylvania), and at the latter time was promoted to supervisor of the Altoona yard of the Pennsylvania. In 1899, he was promoted to assistant engineer maintenance of way at Altoona, and on August 1, 1900, he was further promoted to principal assistant engineer at Altoona. In January, 1901, he entered the operating department as superintendent of the Altoona division, which position he held until June 1, 1903, when he returned to the engineering department as engineer maintenance of way with headquarters at Philadelphia. On April 1, 1905, he was promoted to assistant chief engineer, and on March 1, 1906, he was further promoted to chief engineer of the lines east of Pittsburgh and Erie, holding this position until March 1, 1920, when he was promoted to chief engineer of the system, with headquarters at Philadelphia. On February 1, 1927, Mr. Shand was promoted to the newly created position of assistant to vice-president, in which capacity he was assigned special engineering duties in connection with the plans for the new Philadelphia passenger station, which position he was holding at the time of his retirement on August 1.

Engineering

W. C. E. Robinson, assistant engineer on grade separation at Toronto, Ont., for the Canadian Pacific, has been promoted to division engineer of the Toronto Terminal division, with headquarters at Toronto, to succeed **M. Kelly,** deceased.

Ralph C. Haynes, of the engineering department of the Minneapolis & St. Louis, has been promoted to supervisor of work equipment, with headquarters at Minneapolis, Minn. Mr. Haynes has jurisdiction over all divisions and reports to the chief engineer.

H. A. Lathrop, assistant engineer on the Los Angeles division of the Southern Pacific, has been promoted to assistant division engineer of the Coast division, with headquarters at San Francisco, Cal., to succeed **J. B. Dawson,** whose promotion to division engineer of the New Mexico division with headquarters at El Paso, Tex., was noted in the August issue.

Pusey Jones, chief draftsman in the office of the engineer of structures of the Boston & Maine at Boston, Mass., has been appointed assistant structural engineer on the staff of the chief engineer of the Cincinnati Union Terminal at Cincinnati, Ohio. Mr. Jones entered the service of the B. & M. in 1916, and during the World War was acting engineer of structures while **B. W. Guppy,** engineer of structures, was serving as a colonel with the American forces in France.

E. Bennett has been appointed engineer maintenance of way on the Southern with headquarters at Knoxville, Tenn., succeeding **J. A. Killian,** deceased. The office of engineer maintenance of way, Charlotte, N. C., has been abolished and the jurisdiction of the engineer maintenance of way at Knoxville has been extended to include the Memphis and Charleston district, while the Piedmont district has been added to the territory of the engineer maintenance of way at Danville, Va.

J. A. Armstrong, assistant engineer on the Northern division of the St. Louis-San Francisco, with headquarters at Ft. Scott, Kan., has been promoted to division engineer of that division, with the same headquarters, to succeed **D. E. Gelwix,** whose promotion to maintenance assistant to the general manager is noted elsewhere in this issue, and **B. H. Crossland,** terminal roadmaster at Kansas City, Mo., has been

promoted to assistant engineer at Ft. Scott to succeed Mr. Armstrong. **E. L. Brand,** assistant engineer on the River division at Chaffee, Mo., has been promoted to division engineer of that division to replace **G. W. Koontz,** who has been transferred to the Southern division, with headquarters at Memphis, Tenn., where he succeeds **J. H. Brooking,** resigned.

J. C. Patterson, superintendent of maintenance on the Erie, with headquarters at New York, has been promoted to chief engineer of maintenance, with the same headquarters, and the office of superintendent of maintenance has been abolished. Mr. Patterson was born at Carmichaels, Pa., on January 21, 1882, and graduated from the Pennsylvania State College in 1905, entering railway service in June of the latter year as a rodman in the maintenance of way department of the Pennsylvania. In August, 1906, he became a draftsman on the New York Central & Hudson River (now a part of the New York Central), and in April, 1907, entered the service of the Cleveland, Cincinnati, Chicago & St. Louis, where he was engaged in location surveys. In October of the same year, he became a field engineer for John C. O'Bryan, consulting engineer, remaining in that position until April, 1909, when he re-entered railway service as an assistant engineer on the Chicago Great Western. In July, 1913, Mr. Patterson was appointed chief draftsman on the Erie, and was promoted to assistant valuation engineer in May, 1916. He was made office engineer in February, 1917, and was promoted to principal assistant engineer in June, 1918. In March, 1920, he was promoted to regional engineer of the New York region, and in February, 1927, was further promoted to superintendent maintenance of way.

G. H. Schlotterer, supervisor on the Eastern division of the Pennsylvania, with headquarters at Freedom, Pa., has been promoted to division engineer of the Indianapolis division, with headquarters at Indianapolis, Ind. **J. M. Fox,** division engineer at Erie, Pa., has been transferred to the Cleveland division, with headquarters at Cleveland, Ohio, to succeed **H. T. Frushour,** whose promotion to superintendent of the Monongahela division was noted in the August issue.

Mr. Schlotterer was born on January 29, 1893, at Brooklyn, N. Y., and was educated at Rutgers College, where he graduated in 1915, entering railway service in the same year as a chainman on an engineering corps on the Pennsylvania. He was later promoted to transitman, and in April, 1917, was granted a leave of absence to serve as a commissioned officer in the American Expeditionary Forces. Following his return to civil life in April, 1919, he was promoted to assistant supervisor on the New York division, with headquarters at New Brunswick, N. J., later being transferred to the Middle division, and then back to the New York division at New Brunswick. Mr. Schlotterer was promoted to supervisor with headquarters at West Brownsville, Pa., in 1925. On June 1 of the same year, he was appointed assistant supervisor at West Philadelphia, Pa., and in January, 1926, he was again promoted to supervisor, with headquarters at Ravenna, Ohio.

Changes on the Northern Pacific

Following the promotion of **H. E. Stevens,** chief engineer, to vice-president in charge of operation, a number of changes have been made in the engineering department of the Northern Pacific. **Bernard Blum,** engineer maintenance of way of the lines east of Paradise, with headquarters at St. Paul, Minn., has been promoted to chief engineer, and the title of **A. F. Stotler,** assistant chief enginer and engineer maintenance of way of lines west of Paradise, with headquarters at Seattle, Wash.. has been changed to assistant chief engineer, the positions of engineer maintenance of way of lines east and west of Paradise having been abolished. **J. T. Derrig,** district engineer, with headquarters at St. Paul, has been promoted to assistant to the chief engineer, a newly created position, with headquarters at the same point, and **H. F. Brown,** assistant district engineer, with headquarters at St. Paul, has been promoted to district engineer to succeed Mr. Derrig, with headquarters at the same point. **P. E. Thian,** valuation engineer, with headquarters at St. Paul, has been promoted to consulting engineer, a newly created position, with headquarters at the same point, and **A. C. Terrell** has been appointed valuation engineer to succeed him.

Bernard Blum

Mr. Blum was born on February 12, 1883, at Chicago and was educated at the Massachusetts Institute of Technology, where he graduated in 1904. He entered railway service in 1905 with the Chicago Junction, and in 1907 became an assistant engineer in the construction department of the Northern Pacific in Montana. He was promoted to assistant division engineer at Livingston, Mont., in December, 1909, and in October, 1910, became a roadmaster at Duluth, Minn. He was later promoted to assistant district engineer, with headquarters at St. Paul, and on January 1, 1917, was further promoted to district engineer, with headquarters at the same point. Mr. Blum was promoted to engineer maintenance of way of the lines east of Paradise in July, 1919.

P. E. Thian

Mr. Thian was born on July 13, 1862, at Washington, D. C., and was educated at Georgetown University. He entered railway service in 1881 as a chainman on the Denver & Rio Grande. He was a topographer and transitman on the Canadian Pacific from 1882 to 1884, becoming an assistant engineer on the Chicago, Milwaukee & St. Paul on the construction of the bridge over the Missouri river at Kansas City, Mo., in the latter year. He was engaged in mining in the Canadian Northwest in 1888 and 1889, when he became a locating and construction engineer on the Northern Pacific. He was engaged in government and municipal engineering work from 1890 to 1898, returning to railway service in the latter year as assistant engineer on the Kootenai Valley (now a part of the Great Northern). He became a locating engineer on the Algoma Central (now the Algoma Central & Hudson Bay) in 1901, and later in the same year, left railway service to engage in mining and the practice of engineering on both public and private projects. In 1905, Mr. Thian was appointed chief engineer of the Midland of Manitoba, and other subsidiaries of the Great Northern, in which position he remained until 1908, when he became an engineer on location and construction on the Northern Pacific in North Dakota and Montana. He was promoted to valuation engineer, with headquarters at St. Paul, in 1913.

Mr. Derrig was born on April 26, 1884, at Montrose, Minn., and after attending Coton College entered railway service in 1907 as a chainman on the Northern Pacific, and was successively

rodman and inspector on construction, transitman on location surveys, and resident engineer and assistant engineer on construction until 1912, when he was promoted to assistant engineer in charge of location. In 1914, he became an assistant engineer on the Great Northern at St. Paul, returning to the Northern Pacific in 1916 as assistant engineer in charge of construction at Billings, Mont. In 1918, Mr. Derrig was placed in charge of coal surveys in the state of Montana and in the following year, he was promoted to district engineer.

Mr. Terrell was born in 1876 at Macon, Mo., and graduated from Cornell University in 1900. He entered railway service in the same year as a rodman and instrument man on the Chicago, Burlington & Quincy, and in September, 1901, became a resident engineer on the St. Louis-San Francisco. He entered the service of the Chicago, Rock Island & Pacific in 1904, where he was successively resident

A. C. Terrell

engineer and division engineer. In 1906, he became a resident engineer on the Northern Pacific and subsequently served as assistant engineer on maintenance, division engineer on maintenance and assistant engineer on various projects. In 1916, he was made a division engineer in the valuation department.

Track

P. Moran, section foreman on the Chicago, Rock Island & Pacific, has been promoted to roadmaster on the Iowa division, with headquarters at Oskaloosa, Iowa, succeeding **J. Dulin,** who has retired.

Frank A. Tranzow, supervisor on the Grand Trunk Western, with headquarters at Durand, Mich., has been promoted to superintendent of track, with headquarters at Detroit, Mich., to succeed **John H. Reagan,** deceased.

N. E. Farmer, section and extra gang foreman on the Missouri Pacific, has been promoted to acting roadmaster on the Little Rock district of the Arkansas division, with headquarters at Benton, Ark., to succeed **J. Cranford,** who has been transferred to the De Quincy division of the Gulf Coast Lines.

John Tangney, roadmaster of the Exeter district of the San Joaquin division of the Southern Pacific with headquarters at Exeter, Cal., has been transferred to the Alameda district of the Western division, with headquarters at Niles, Cal., to succeed **H. C. Roland,** who has been transferred to the Exeter district to succeed Mr. Tangney.

Corbett W. Coil, roadmaster on the Rocky Mountain division of the Northern Pacific with headquarters at Helena, Mont., has been promoted to acting division roadmaster of the Fargo division, with headquarters at Fargo, N. D., and **Frank C. Welch,** assistant roadmaster on the St. Paul division, has been promoted to acting roadmaster of the Rocky Mountain division, with headquarters at Helena, to succeed Mr. Coil.

G. L. Bartels, track foreman on the Cincinnati division of the Pennsylvania, has been promoted to acting supervisor on the St. Louis division, with headquarters at Decatur, Ill., to succeed **J. E. Boland,** transferred. **J. D. Archibald** has been appointed supervisor on the Renovo division, with headquarters at Warren, Pa., to succeed **W. W. Hubely,** who has been promoted to maintenance of way inspector on the Erie and Ashtabula division. **Spencer Dabney,** supervisor at Canton, Ohio, has been transferred to the Eastern division, with headquarters at Freedom, Pa., to succeed **G. H. Schlotterer,** whose promotion to division engineer is noted elsewhere in this issue.

Martin H. Bootjer, whose promotion to roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Manly, Iowa, was noted in the August issue, was born in October, 1894, at Wilhelmshaven, Germany. He was educated in high schools in Germany and at Chapin, Iowa, and at the University of Commerce at Mason City, Iowa, and entered railway service on April 7, 1914, as an extra gang timekeeper and later served as a section laborer and agent on the same division. He was transferred to the Illinois division as an extra gang timekeeper on April 3, 1916, and on May 23, 1917, was granted a leave of absence to enlist in the United States Army, where he served in the 13th Engineers (Railway). On his return to civil life on June 24, 1919, he resumed his work as a timekeeper on the Illinois division, and on October 24, of the same year, was promoted to foreman of the Silvis (Ill.) yard. He was later made an extra gang foreman on the Illinois division, since which date he has also acted as yard foreman and rail saw foreman at various times until his recent promotion to roadmaster of the Cedar Rapids-Minnesota division.

H. E. Kemp, extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to roadmaster, with headquarters at Madison, S. D., to succeed **J. A. Larkoski,** who has been transferred to the I. & D. division at Mason City, Iowa, to take the place of **H. Casper,** who, on account of ill-health, has been appointed assistant roadmaster on the same division, to relieve him of more arduous duties. **R. R. Lowe,** extra gang foreman, has been promoted to roadmaster on the Kansas City division, with headquarters at Ottumwa, Iowa, to succeed **E. Schoech,** who has been transferred to the Terre Haute division at Terre Haute, Ind., where he succeeds **J. Gilkison,** who has been appointed assistant roadmaster on the same division, in order to relieve him of more active duties, on account of ill-health. **J. H. Johns,** roadmaster on the Iowa division, at Marion, Iowa, has been transferred to the Northern division at Horicon, Wis., to take the place of **J. J. Van Bockern,** who has been transferred to the Madison division at Janesville, Wis., where he replaces **T. C. Barrett,** who, in turn, has been transferred to Marion, Iowa, to succeed Mr. Johns.

Bridge and Building

Elmer E. Bell, formerly supervisor of bridges and buildings on the Chesapeake & Ohio, with headquarters at Ashland, Ky., has been retired on a pension. Mr. Bell was born on January 1, 1858, at Trinity, Ky., and entered the service of the C. & O. on November 19, 1897, as a carpenter on the Ashland division. On May 1, 1907, he was promoted to carpenter foreman, and on December 17, 1915, was further promoted to supervisor of bridges and buildings at Ashland.

Purchasing and Stores

C. E. Kelsey has been appointed purchasing agent of the Denver & Salt Lake, with headquarters at Denver, Colo., to succeed **A. Knodt.**

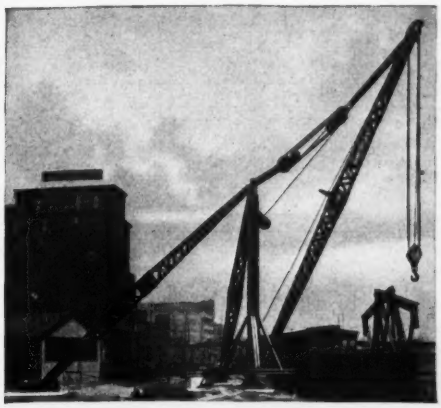
H. W. Nelson has been appointed purchasing agent of the New Orleans Great Northern, with headquarters at New Orleans, La., to succeed **G. W. Grassner.**

Obituary

William A. Parker, purchasing agent of the Bessemer & Lake Erie and the Union Railroad, with headquarters at Pittsburgh, Pa., died on August 6 at Hesston, Pa.

James Mulder, general supervising lumber and tie inspector of the New York Central Lines, with headquarters at New York, died on July 6, following a brief illness.

Edward Robichaud, roadmaster on the Denver & Rio Grande Western, with headquarters at Glenwood Springs, Colo., was killed on July 29, when the motor car on which he was riding was struck by a train near Glenwood Springs.



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Right of way fences erected properly with steel posts keep out livestock and trespassers and keep the farmers and the public along your road satisfied that every precaution is being taken to prevent accidents. This also means reducing losses through liability and property damage.

American Railroad Fence and Banner Steel Posts meet every specification recommended by the American Railway Engineering Association.

Using Banner Steel Posts not only insures better looking fence but saving labor in fence building. A test made by a leading railroad proved that one man could drive five Banner Posts in the same time required for setting one wooden post.

American Steel & Wire Co.

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**United States Steel Products Co.*

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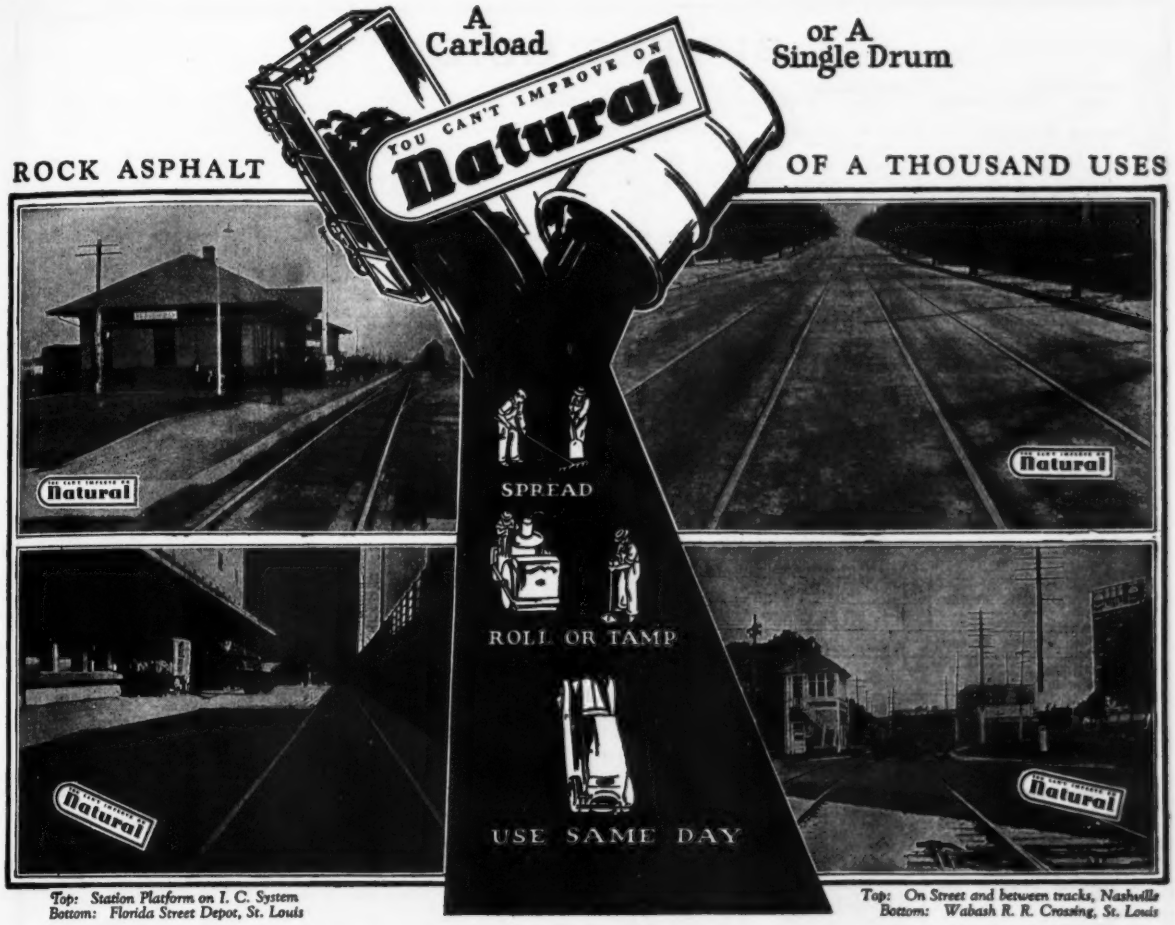

Top: Station Platform on I. C. System
Bottom: Florida Street Depot, St. Louis

Top: On Street and between tracks, Nashville
Bottom: Wabash R. R. Crossing, St. Louis

A Complete Surface Material

no mixing—no heating—no delay

AS SOON as Natural Rock Asphalt is received from the plant, it is ready for use. It does not have to be mixed with other materials; it does not even have to be heated. Simply spread it on its base, roll or tamp it, and it is ready for traffic.

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You can buy just the quantity of Natural Rock Asphalt that is required for your job—as it is sold in easily unloaded open top cars or in convenient drums. If any of the material is left over, it can be stored indefinitely indoors or out and used when it is needed.

Due to the special characteristics of the Pottsville Rock Asphalt Formations in Edmonson County, Kentucky, from which Natural Rock Asphalt is quarried, surfaces of this material are tough, resilient, non-skid, do not shove or wave and are easy to maintain.

Non-Skid
Easily Stored
Long Wearing
Resilient
Uniform

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Some of the railroad uses of Natural Rock Asphalt are: on crossings, platforms, bridges, between tracks, on warehouse, shop and recreation floors, etc. Its resiliency, durability, non-skid surface, ease of storage, insulative and preservative qualities suit it particularly to these uses.

Mail this coupon for free book describing Natural Rock Asphalt and its Railroad uses.

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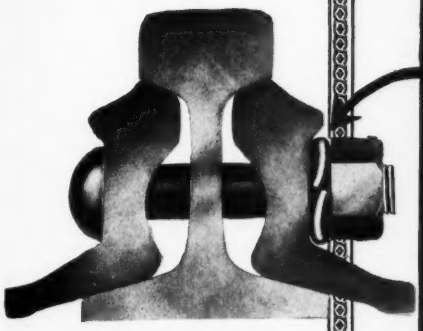

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This is point of superiority No. 7.

IMPROVED HIPOWER

THE STANDARD

Improved Hipower is usually specified. Sometimes as a matter of course because it is generally accepted as the standard by most roads.

Sometimes because one or two of its points of superiority meet a special condition.

We want it to remain the standard of railroad spring washers always, but we also want its many specific advantages to be well known everywhere.

That is why in most of our advertisements this year we take up the many points of Improved Hipower superiority one by one. Whenever it is specified, it should be with the full knowledge that it is, for several sound reasons, the best that can be had.

REQUIRES WRENCHING LESS FREQUENTLY

A WEAK spring washer or no spring washer at all permits the rapid loosening of joint members. The incessant impacts of traffic grind the contact surfaces of rails and joint bars until inevitable wear gradually permits play in the bolts. Some track bolts can be rattled with your fingers between trips of the track maintenance crews. IMPROVED HIPOWER—the stiffest spring washer on the market—withstands such impacts and holds the bolts tight longer than the less powerful spring washers. Therefore, less frequent wrenching to tighten up the bolts is needed; and thousands of dollars are saved in maintenance costs.

Practical experience on many of the leading roads has demonstrated this point during recent years when reduction in operating expenses has been so vital.

There are many other points of superiority. Our advertisements will announce them.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

IMPROVED HIPOWER

Commercially Non-flattenable - - Permanently Rust-Proof